JHR 75: 15–65 (2020)
doi: 10.3897/jhr.75.47006
http://jhr.pensoft.net

REVIEW ARTICLE

JOURNAL OF Hymenoptera RESEARCH
A peer-reviewed open-access journal
The International Society of Hymenopterists

A review of the genus *Orthocentrus* Gravenhorst (Hymenoptera, Ichneumonidae, Orthocentrinae) from South Korea

Andrei E. Humala[1], Jong-Wook Lee[2], Jin-Kyung Choi[3]

1 *Forest Research Institute, Karelian Research Centre, Russian Academy of Sciences, 185910, Petrozavodsk, Russia* **2** *Department of Sciences, Yeungnam University, Gyeongsan, 38541, South Korea* **3** *Department of Science Education, Daegu National University of Education, Daegu, 42411, South Korea*

Corresponding author: Jin-Kyung Choi (jkchoi624@dnue.ac.kr)

Academic editor: G. Broad | Received 2 October 2019 | Accepted 16 December 2019 | Published 27 February 2020

http://zoobank.org/69D2154C-21AC-463D-A0B4-A56ACAF37FE3

Citation: Humala AE, Lee J-W, Choi J-K (2020) A review of the genus *Orthocentrus* Gravenhorst (Hymenoptera, Ichneumonidae, Orthocentrinae) from South Korea. Journal of Hymenoptera Research 75: 15–65. https://doi.org/10.3897/jhr.75.47006

Abstract

Twenty six species of the genus *Orthocentrus* Gravenhorst occurring in South Korea are reviewed. This is the first record of the genus from South Korea. Fifteen species, *O. brachycerus* **sp. nov.**, *O. caudalis* **sp. nov.**, *O. consobrinus* **sp. nov.**, *O. flavescens* **sp. nov.**, *O. koreanus* **sp. nov.**, *O. leei* **sp. nov.**, *O. leucostomus* **sp. nov.**, *O. orientalis* **sp. nov.**, *O. pacificus* **sp. nov.**, *O. parvus* **sp. nov.**, *O. pulchellus* **sp. nov.**, *O. setosus* **sp. nov.**, *O. tenuiventris* **sp. nov.**, *O. trichophthalmus* **sp. nov.** and *O. trichoptilus* **sp. nov.**, are described as new, and ten more species are recorded from South Korea for the first time. *Orthocentrus consobrinus* **sp. nov.** is also reported from Russia, *O. caudalis* **sp. nov.** from China, and *O. winnertzii* from Japan. A key to *Orthocentrus* species occurring in South Korea is provided. The status of *O. stigmaticus* Holmgren, 1858 as a valid species is resurrected (**stat. rev.**).

Keywords

Fauna, key, Korea, new species, Palaearctic region, parasitoids, taxonomy

Copyright *Andrei E. Humala et al.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Introduction

Orthocentrinae is a moderately large cosmopolitan subfamily of about 500 described species (Yu et al. 2016). Most orthocentrines are known to be koinobiont endoparasitoids of primitive dipteran hosts of the superfamily Sciaroidea. Only the Western Palaearctic fauna of this subfamily has been studied relatively well, although some genera should be revised even for Europe. The Eastern Palaearctic fauna has been poorly studied, only twelve species of orthocentrines from six genera are known in China and 17 species from 14 genera in Japan (Humala 2007, Yu et al. 2016, Watanabe 2016, 2018, 2019a, b). In the catalogue of Ichneumonidae of the Russian Far East (Kasparyan et al. 2012) there are 28 genera and 110 species of Orthocentrinae s. l. (including Microleptinae, Cylloceriinae and Diacritinae). The genera most rich in species in Russian Far East are *Eusterinx* Förster (13 species known), *Megastylus* Schiødte (8 species), *Orthocentrus* Gravenhorst, 1829 (4 species), *Stenomacrus* Förster, 1869 (2 species), *Plectiscidea* Viereck, 1914 (9 species), and *Proclitus* Förster, 1869 (9 species), but many genera need to be revised and these number are a poor reflection of actual diversity. South Korean orthocentrines are poorly known (Humala et al. 2016). Eighteen Orthocentrinae genera have been found to occur in South Korea: *Batakomacrus* Kolarov, 1986, *Neurateles* Ratzeburg, 1848, *Orthocentrus* Gravenhorst, *Picrostigeus* Förster, 1869, *Stenomacrus* Förster, *Plectiscus* Gravenhorst, 1829, *Aperileptus* Förster, 1869, *Apoclima* Förster, 1869, *Dialipsis* Förster, 1869, *Entypoma* Förster, 1869, *Eusterinx* Förster, 1869, *Gnathochorisis* Förster, 1869, *Helictes* Haliday, 1837, *Megastylus* Schiødte, 1838, *Pantisartrus* Förster, 1871, *Plectiscidea* Viereck, *Proclitus* Förster, and *Symplecis* Förster, 1869. All these genera are entirely or predominantly Holarctic, and many of them are abundant and species-rich genera. Recently the Korean species from the genera *Gnathochorisis* (5 species), *Symplecis* (2 species) and *Eusterinx* (9 species) were reviewed (Humala et al. 2016, 2018), and a review of the genera *Megastylus* and *Helictes* is in process (Choi et al. in prep.). However, the majority of Orthocentrinae genera have not been taxonomically treated yet, including *Stenomacrus* and *Plectiscus*, rich in species in the local fauna.

Orthocentrus is a large and worldwide genus comprising 95 extant described species (Yu et al. 2016), with the majority of species in the Palaearctic and Neotropical regions. The European fauna of *Orthocentrus* was revised by Aubert (1978), however his revision cannot be considered exhaustive, since it is based only on his own material from the Mediterranean area and Holmgren and Thomson collections. The Eastern Palaearctic fauna of the genus is poorly studied – only eleven species have been recognized there: among them, four species were reported from the Russian Far East, two species from China and one species from Japan, the remaining species were reported from Iran (Yu et al. 2016). The genus *Orthocentrus* was not recorded from South Korea hitherto.

The aim of this work is to review the Korean species of the genus *Orthocentrus*, describe new taxa and provide an identification key to species occurring there.

Materials and methods

A large quantity of material of Korean Orthocentrinae from the Animal Systematic Laboratory of the Yeungnam University (Gyeongsan, South Korea), collected by sweep-netting and Malaise traps, was examined. Additional specimens were borrowed from the National Institute of Agricultural Sciences. Colour photographs were taken with an AxioCam MRc5 camera attached to a stereo microscope Zeiss SteREO Discovery V20. Images were combined from stacks of photographs using AxioVision SE64 software (Carl Zeiss), and optimized with a Delta imaging system (i-solution, IMTi-Solution Inc.).

The morphological terminology generally follows Gauld (1991), except for the terms 'temple' for the upper part of the gena, between the eye and the occipital carina, 'nervellus' for the combined hind wing veins Cu and cu-a, and postocellar line (**POL**) – the shortest distance between the lateral ocelli. Descriptions of sculpture are based on Eady (1968).

The material used in this study, including the holotype specimens, is deposited mostly in the Department of Science Education, Daegu National University of Education, Daegu, South Korea. Some paratype specimens will be deposited in the Zoological Institute, Russian Academy of Sciences, St Petersburg, Russia.

In 'Distribution' sections the new records are marked by an asterisk (*) and all scale bars are 1 mm.

Abbreviations are used as follows:

CB Chungcheongbuk-do;
CN Chungcheonnam-do;
GB Gyeongsangbuk-do;
GN Gyeongsangnam-do;
GG Gyeonggi-do;
GW Gangwon-do;
JB Jeollabuk-do;
JJ Jeju-do;
JN Jellanam-do;
MT Malaise trap;
DNUE Daegu National University of Education, Science Education, Daegu, South Korea;
NIAS National Institute of Agricultural Sciences, South Korea;
ZIN Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia.

Taxonomy

Family Ichneumonidae Latreille, 1802
Subfamily Orthocentrinae Förster, 1869

Genus *Orthocentrus* Gravenhorst, 1829

Orthocentrus Gravenhorst, 1829: 1–1097. Type species: *Orthocentrus anomalus* Gravenhorst, 1829.

Diagnosis. Clypeus fused with face, forming uniformly convex surface; lower edge of clypeus usually convex or truncate; labrum hidden. Antennal scape unusually long, subcylindrical. Mandibles narrowed apically, not overlapping when closed; lower tooth much shorter than upper tooth, or sometimes completely reduced. Malar space with or without subocular sulcus. Fore wing with pentagonal areolet or without areolet. Hind wing with abscissa of vein Cu present or absent; nervellus reclivous, inclivous or vertical. Ovipositor straight or upcurved, with or without dorsal subapical notch, short, as a rule not longer than apical height of metasoma; ovipositor sheaths with setae along most of the length, except at the very base. Legs generally robust.

Remarks. Twenty five species of the genus *Orthocentrus* have been recognized in South Korea, of them fifteen species are new to science. The genus is characterized by significant sexual dimorphism, which often leads to the inability to confidently establish that males and females belong to the same species.

Key to *Orthocentrus* species occurring in South Korea

(Females only)

1 Face and frons yellow except for interocellar area (Fig. 13C). Median part of mesoscutum with yellow bars along notauli (Fig. 13E). Fore wing without areolet (Fig. 13F) ..... **18. *O. pulchellus* sp. nov.**

– Face and frons both never entirely yellow. Mesoscutum fuscous or with light bars along notauli. Fore wing with or without areolet **22**

2 Eyes densely setose (Figs 6B, 15F, 17B, 18B) **3**

– Eyes without conspicuous setae **6**

3 Antenna with 45 flagellomeres, first flagellomere 2.3 times as long as wide (Fig. 17A). Larger species (fore wing about 4.0 mm) .... **24. *O. trichophthalmus* sp. nov.**

– Antenna with 24–38 flagellomeres, first flagellomere 0.8–1.2 times as long as wide. Smaller species (fore wing 2.0–3.0 mm) **4**

4 Antenna longer than fore wing, with 37–38 flagellomeres, first flagellomere elongate ..... **8. *O. hirsutor* Aubert**

– Antenna shorter than fore wing, with 24–26 flagellomeres **5**

5 Face, mesoscutum, propleuron and mesopleuron fuscous (Fig. 18A, B, D, E); vertex dark brown (Fig. 18C); second tergite with weak shallow transverse depression in apical half (Fig. 18G). Fore wing with vein cu-a slightly distad of Rs&M; pterostigma nearly symmetrical; (Fig. 18F). Antennae short, flagellum serrate (Fig. 18A) ..... **25. *O. trichoptilus* sp. nov.**

– Face, mesoscutum, propleuron and mesopleuron yellowish (Fig. 15A, B, E); vertex brown with large creamy orbital marks (Fig. 15F); second tergite with strong transverse furrow in apical half (Fig. 15D). Fore wing with vein cu-a oblique, well distad of Rs&M; pterostigma strongly asymmetrical (Fig. 15C) .... **20. *O. setosus* sp. nov.**

6 Ovipositor 2.6 times as long as hind basitarsus and as long as hind femur (Fig. 3A, E) ..... **4. *O. caudalis* sp. nov.**

– Ovipositor at most as long as hind basitarsus, does not exceed apical height of metasoma 7

7 Second tergite 2.0–2.9 times as long as posteriorly wide (Fig. 16G). Metasoma long and slender, about 2.0 times as long as head and mesosoma together (Fig. 16A) ..... **23. *O. tenuiventris* sp. nov.**

– Second tergite at most 1.8 times as long as posteriorly wide. Metasoma not longer than 1.8 times as long as head and mesosoma together **8**

8 Metasomal tergites 2–3 with strong transverse-diagonal furrows separating creamy latero-posterior corners (Fig. 5G) **9**

– Metasomal tergites 2–3 without strong transverse-diagonal furrows, if such furrows present on tergite 2, there is no colour difference between latero-posterior corners and anterior part of tergite **10**

9 Areolet absent (Fig. 5F); antenna with 20 flagellomeres; mesosoma mostly light-brown (Fig. 5D, E) ..... **6. *O. flavescens* sp. nov.**

– Areolet present; antenna with 27–29 flagellomeres; mesosoma mostly dark-brown (Fig. 1C) ..... **3. *O. castellanus* Ceballos**

10 Head lenticular in lateral view (Figs 4D, 7D); face flattened **11**

– Head not lenticular in lateral view; face convex **14**

11 Areolet present (Figs 4F, 7F); flagellum with more than 20 flagellomeres **12**

– Areolet absent (Figs 2A, 8F); flagellum with 19–20 flagellomeres **13**

12 First tergite 1.5 times as long as posteriorly wide (Fig. 4G). Flagellum short, with 21 flagellomeres; temple 0.18 times as wide as eye (Fig. 4C); face brown (Fig. 4B) ..... **5. *O. consobrinus* sp. nov.**

– First tergite 2.1 times as long as posteriorly wide (Fig. 7G). Flagellum longer, with 26–27 flagellomeres; temple 0.3 times as wide as eye (Fig. 7C); face yellowish (Fig. 7B) ..... **9. *O. koreanus* sp. nov.**

13 Face and frontal orbits mostly yellow up to level of lateral ocelli (Fig. 2B); POL 1.8 times as long as diameter of lateral ocellus (Fig. 2D) ..... **2. *O. brachycerus* sp. nov.**

– Face fuscous, frontal orbits with yellowish marks only close to antennal sockets (Fig. 8B); POL 1.1 times as long as diameter of lateral ocellus (Fig. 8C) ..... **10. *O. leei* sp. nov.**

14 Inner orbits yellowish up to level of lateral ocelli (Fig. 9C); face fuscous, malar space creamy (Fig. 9D) ..... **11. *O. leucostomus* sp. nov.**

– Inner orbits fuscous, at most with yellowish marks not reaching level of front ocellus; if face fuscous, malar space fuscous **15**

15 First flagellomere distinctly elongate, 1.8–2.5 times as long as wide; nervellus intercepted in the middle or below middle **16**

– First flagellomere from transverse to slightly elongate, 0.9–1.3 times as long as wide; nervellus intercepted below middle or not intercepted **18**

16 Second tergite 1.3 times as long as posteriorly wide; first tergite 1.8 times as long as posteriorly wide, with lateromedian longitudinal carinae subparallel .... **12. *O. marginatus* Holmgren**

– Second tergite 1.8 times as long as posteriorly wide; first tergite 2.0–2.1 times as long as posteriorly wide, with lateromedian longitudinal carinae somewhat convergent posteriorly **17**

17 Face smooth (Fig. 10B). Antenna with 22–24 flagellomeres; fore wing with areolet narrowly sessile (Fig. 10F); nervellus intercepted in lower 0.4..... ..... **13. *O. orientalis* sp. nov.**

– Face granulate (Fig. 6F). Antenna with 30 flagellomeres; areolet large, widely sessile, pentagonal (Fig. 6E); hind wing with nervellus intercepted in the middle.... ..... **16. *O. patulus* Holmgren**

18 Frontal orbits above antennal sockets with large yellow marks (Figs 1B, 14D) **19**

– Frontal orbits above antennal sockets at most with indistinct small yellowish spots close to antennal sockets **20**

19 Face granulate (Fig. 1B); antenna with 25–28 subquadrate flagellomeres, first flagellomere as long as wide; areolet narrowly sessile; nervellus not intercepted; legs entirely rufous (Fig. 1A); second tergite without polished posterior corners separated by a transverse-diagonal groove..... **1. *O. asper* Gravenhorst**

– Face nearly smooth, finely transversely striate (Fig. 14D); antenna with 20–24 flagellomeres, first flagellomere distinctly elongate; areolet narrow or sometimes open; nervellus intercepted in lower third; hind coxa infuscate (Fig. 14E); second tergite with polished posterior corners separated by a transverse-diagonal groove ..... **19. *O. sannio* Holmgren**

20 Face finely punctate (Figs 11B, 12B); fore wing with areolet **21**

– Face granulate (Figs 10B, 14B, 19B); fore wing with or without areolet..... **24**

21 Temples about 0.25 times of eye width (Fig. 12D); occipital carina absent. Smaller species, fore wing length 1.7 mm ..... **15. *O. parvus* sp. nov.**

– Temples wider (Fig. 11C); occipital carina present or absent. Larger species, fore wing length at least 2.2 mm **22**

22 Hind legs partly fuscous, hind coxa brown to black (Fig. 14E). Head almost cubic, subocular sulcus not developed; occipital carina absent; notauli not developed. Face fuscous (Fig. 14F)..... **21. *O. spurius* Gravenhorst**

– All legs entirely red; subocular sulcus distinct; occipital carina present, often reduced dorsally; mesoscutum anteriorly with distinct notauli (Fig. 11A, E). Face yellowish or infuscate **23**

23 Antenna with 25–29 flagellomeres; second tergite as long as posteriorly wide or transverse, polished with distinct longitudinal striae; vein Rs+2r meeting pterostigma at proximal 0.4 (Fig. 1E). Larger species, fore wing 3.4–4.0 mm..... ..... **7. *O. fulvipes* Gravenhorst**

– Antenna with 24–25 flagellomeres; second tergite 1.2 times as long as posteriorly wide, coriaceous, without striae (Fig. 11G); vein Rs+2r meeting middle of pterostigma (Fig. 11F). Smaller species, fore wing 2.2–2.5 mm..... **14. *O. pacificus* sp. nov.**

24 Second tergite 1.0–1.3 times as long as posteriorly wide; face granulate; areolet present; vertex prominent (Fig. 14B).....**17. *O. protervus* Holmgren**
– Second tergite 1.6–1.8 times as long as posteriorly wide; face convex, more finely sculptured (Fig. 19B); areolet present or absent; vertex not particularly prominent **25**
25 Areolet absent (Fig. 19C); first tergite without lateromedian longitudinal carinae .....**26. *O. winnertzii* Förster**
– Areolet present (Fig. 19A); first tergite with lateromedian longitudinal carinae ... .**22. *O. stigmaticus* Holmgren**

1. *Orthocentrus asper* Gravenhorst, 1829
Figs 1A, B

Biology. Parasitoid of *Sciophila lutea* Macquart (Diptera, Mycetophilidae).

Material examined. South Korea, 1♀, **JN**: Jirisan National Park, Sunduryu, 24.X.1989, J.G. Kim leg. (NIBR–0147); **GB:** 1♀, Uljin-gun, Mt. Baekamsan, 14.V–19.VI.1999, D.S. Ku leg. (NIAS); 1♂, Cheongdo-gun, Mt. Unmunsan, 28.VI.1984, J.G. Kim leg. (DNUE– 0477); **GW**: 1♂, Chuncheon-si, Dong-myeon Iinae-ri, 1–8. VIII.2005, S.J. Jang leg. (DNUE–0122).

Distribution. Holarctic; *South Korea (GB, GW, JN).

2. *Orthocentrus brachycerus* Humala & Lee, sp. nov.
http://zoobank.org/194E053E-96AB-4B55-9A82-8328ACE150AE
Fig. 2

Description. Female. Fore wing length 3.0–3.5 mm.

Face at level of antennal sockets 1.4 times as wide as high; face smooth, polished, sparsely and slightly punctate; eyes not setose; dorsal ridge of face in between antennal sockets with a median blunt low prominence; face profile straight except dorsally very slightly impressed; inner eye orbits slightly divergent ventrally; edge of clypeus straight; antennal sockets not on a distinct high shelf; subocular sulcus distinct, sharp, slightly bent towards occiput; maxillary palp reaching fore coxa. In dorsal view, head posteriorly concave, temples short; lateral ocellus separated from eye by its maximum diameter; POL 1.8 times as long as diameter of lateral ocellus; ocellar-ocular grooves present. Minimum distance between antennal sockets about 0.4× diameter of socket; antenna very short, with 19 flagellomeres (n = 15) gradually shortening towards apex of antenna; basal flagellomere 1.5 times as long as wide and about 0.4× of length of scape; scape slightly convex on inner surface, slightly concave on outer surface.

Mesosoma polished; mesoscutum anteriorly with distinct notauli; in profile, scutellum weakly convex, metapleuron slightly convex; propodeum with posterior

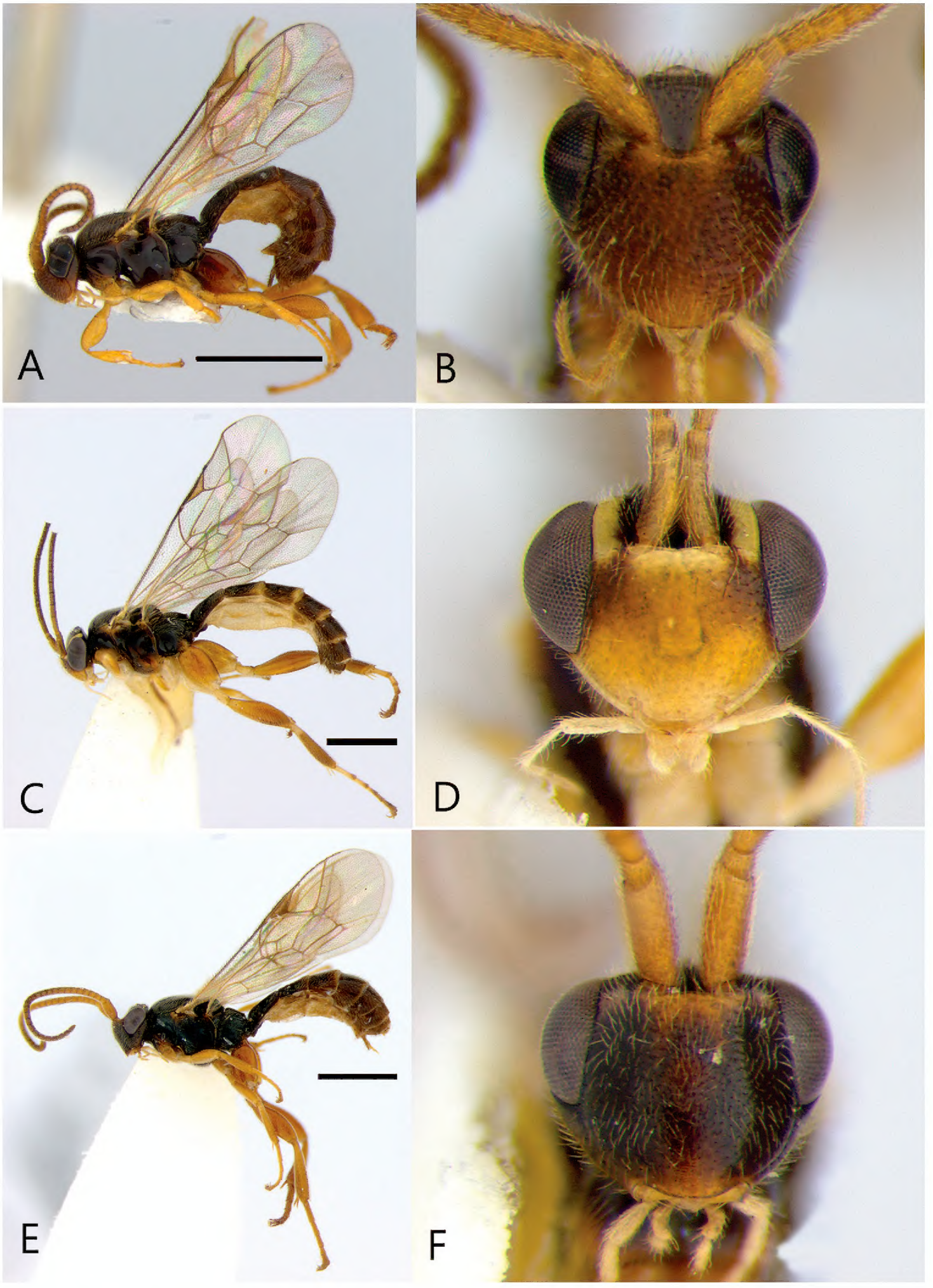

Figure 1. *Orthocentrus* spp. **A** Habitus in lateral view of *O. asper* **B** head in frontal view of *O. asper* **C** habitus in lateral view of *O. castellanus* **D** head in frontal view of *O. castellanus* **E** habitus in lateral view of *O. fulvipes* **F** head in frontal view of *O. fulvipes*.

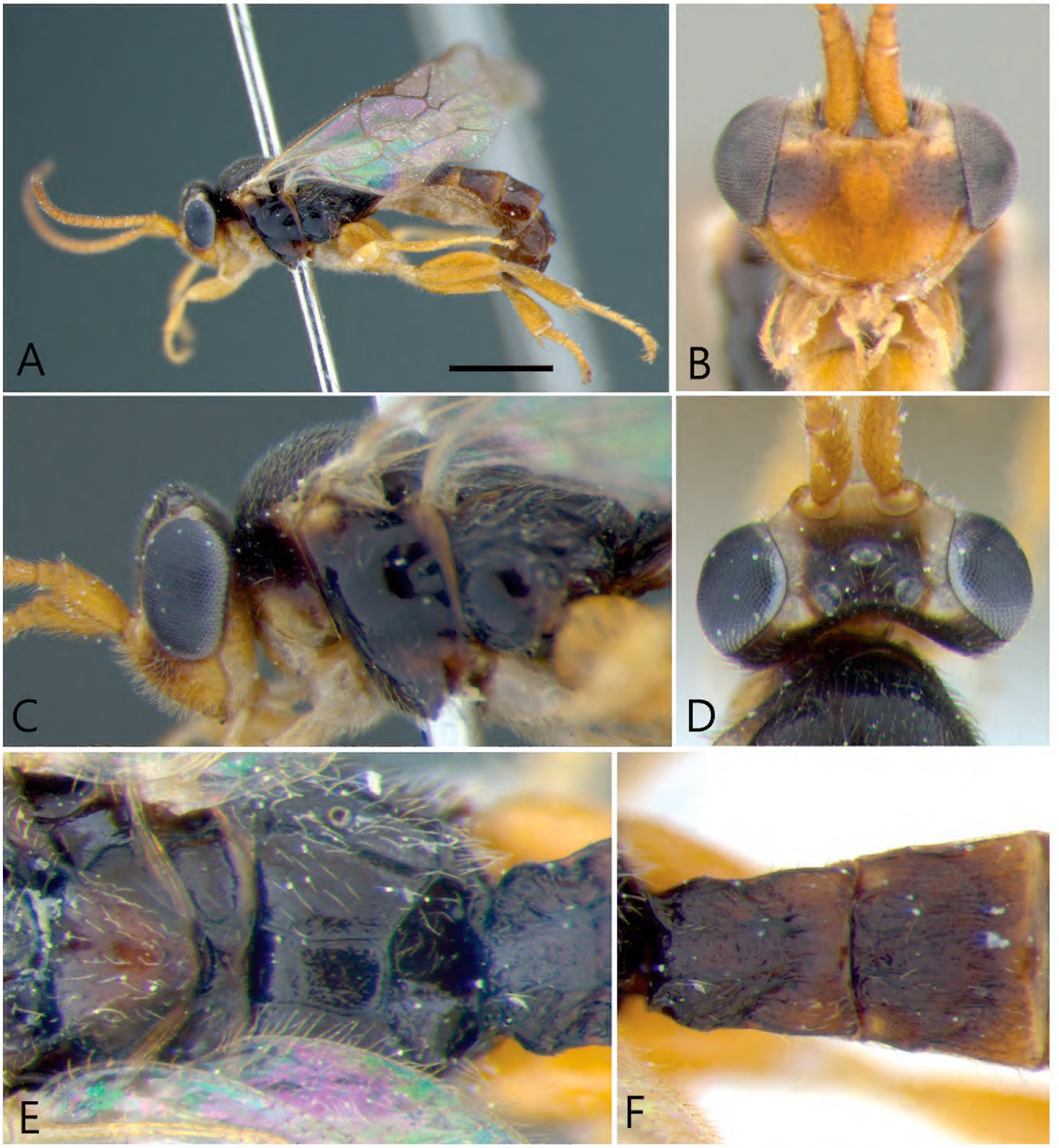

Figure 2. *Orthocentrus brachycerus* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head and mesosoma in lateral view **D** head in dorsal view **E** scutellum and propodeum in dorsal view **F** first and second tergites in dorsal view.

transverse carina complete, strong and raised between lateral longitudinal carinae, lateromedian longitudinal carinae complete, lateral longitudinal carinae distinct, propodeal spiracle small.

Legs robust; coxae polished, femora with coriaceous microsculpture, tibiae and tarsi coriaceous-granulate; hind femur 3.0 times as long as high, hind tibia 4.0 times as long as apically wide, with spine-like setae.

Wings not particularly narrow; fore wing without areolet; vein Rs nearly straight; vein Rs+2r meeting pterostigma at basal 0.45; vein cu-a opposite Rs&M; nervellus intercepted in lower third.

First tergite slightly widening posteriorly, 1.2 times as long as apically wide; coriaceous, with two distinct lateromedian longitudinal carinae and indistinct longitudinal striae, with transverse impressions originating at about middle of tergite, sloping posteriorly, meeting centrally.

Second tergite 0.9 times as long as posteriorly wide; coriaceous and longitudinally striate, sometimes with lateromedian longitudinal carinae in anterior half, anterior corners impressed and transverse groove near posterior margin bending anteriorly near lateral margins, forming a somewhat uplifted area medially with longitudinal striae; thyridia rounded. Third tergite with coriaceous microsculpture anteriorly; remainder of metasoma unsculptured, polished. Ovipositor thin, slightly upcurved, without subapical dorsal notch; ovipositor sheath narrow, with sparse setae.

Body setose except eyes, pronotum, mesopleuron and metapleuron; setae scattered on metasoma and posterior sides of coxae.

Blackish brown; face yellow, sometimes laterally infuscate; inner orbits broadly whitish-yellow up to occiput; antenna orange; malar area yellow posterior to malar sulcus and up to level of lower third of eye; mouthparts, fore and mid coxae, all trochanters and trochantelli yellowish creamy, remainder of fore and mid legs yellow; hind legs orange, posterior margins of tergites 1–4 brown. Sometimes lower mesopleuron and scutellum reddish-brown.

Male. Flagellum with 21 flagellomeres; face and frontal orbits yellow. Otherwise as in female.

Biology. Hosts unknown.

Etymology. Named from the Greek *βραχύς* (short) and *κέρας* (horn) after the short antenna.

Comparison. Compared with the other species that have lenticular head, flattened and smooth face, short temples, and eyes glabrous, the fore wing areolet is absent and the flagellum with fewer than 20 flagellomeres, unlike in *O. koreanus* and *O. consobrinus*. From the allied *O. leei* it differs in the yellow face and frontal orbits up to the level of the lateral ocelli; the POL 1.8 times as long as diameter of an ocellus.

Material examined. ***Holotype:*** female; South Korea, **GB**: Daegu-si, Dalseo-gu, Daegok-dong, Daegusumogwon, 35°48'3.26"N,128°31'15.3"E, 27.VII–8.VIII.2011, J.W. Lee leg. (DNUE-0496).

Paratypes: South Korea, **GB**: 1♀, Daegu-si, Dalseo-gu, Daegok-dong, Daegu Arboretum, 88 m, 35°47'38.6"N, 128°31'33.5"E, 4–18.IV.2012, S.G. Kang leg. (DNUE-0120); 1 ♂, Bongjeongsa 10–11.VII.1998, J.W. Lee leg. (DNUE-0135); **GG**: 3 ♀, Pocheon-si, Soheul-eup, Jikdong-ri, Korean National Arboretum, Gwangeung Forest, MTII, 123 m, 37°45'22"N, 127°9'48.9"E, MT, 15.VII–2.VIII.2013, S.Y. Park, J.O. Lim & J.S. Lim leg. (DNUE); 1♀, Pocheon-si, Soheul-eup, Jikdong-ri, Korean National Arboretum, Gwangeung Forest, MTII, 120 m, 37°45'22"N, 127°9'48.9"E, MT, 28.VI–15.VII.2013, S.Y. Park, J.O. Lim & J.S. Lim leg. (ZIN); 1♂, Schihung-si, Mt. Chongsu, 22.VIII.1988 J.W. Lee leg. (DNUE-0481); **GN**: 1♀,

Dapcheon-ri, Ibanseong-myeon, Jinju-si, MTIII, 27.VI–4.VII.2005, B.K. Ahn leg. (ZIN-0376); **GW**: 2♀, Chuncheon-si, Sanong-dong, Gwangwon Provincial Arboretum, 30.VIII–17.IX.2013, I.G. Kim leg. (DNUE); 2♀, Chuncheon-si, Sanong-dong, Gwangwon Provincial Arboretum, 17.VII–1.VIII-2013, I.G. Kim leg. (DNUE); 1♀, Heungeop-myeon, Maeji-ri, Yeosedae gyonae ungoleong yeop, 37°16'53"N, 127°54'02"E, MT, 19.V–6.VI.2011, J.W. Lee leg. (DNUE–0243); **JB**: 2♀, Wanju-gun, Dongsang-myeon, Daea-ri, San1-2, Daea, 35°58'24.24"N, 127°18'13.53"E, MT, 16–31.VIII.2013, J.M. Park leg (DNUE); 1♀, Iksansi Sinyongdong, Wongwang University, 35°57'N, 126°57'E, MT, 21.VII–17.VIII.2006, J.W. Lee leg. (ZIN-0253); **JN**: 1♀, Kwangju-si Buk-gu, Geumgok-dong, Mudeungsan National Park, Wonhyosa, 35°57'N, 126°57'E, MT, 26.VI–27.VII.2013, J.K. Choi leg. (ZIN-0108).

Distribution. South Korea (GB, GG, GN, GW, JB, JN).

3. *Orthocentrus castellanus* Ceballos, 1963

Figs 1C, D

Biology. Hosts unknown.

Material examined. South Korea, **GB**: 1 ♀, Namsa-ri, Hyeongok-myeon, Kyeongju-si, MTII, 28.VII–11.VIII.2005, J.T. Mun leg. (DNUE); **GG**: 1 ♀, Pocheon-si, Soheur-eup, Jikdong-ri, 51-7, Korean National Arboretum, Saengtae tower, 37°44'56"N, 127°08'54.5"E, 31.V–14.VI.2013, I.G. Kim leg. (DNUE); **GN:** 1 ♂, Sancheong-gun, Mt. Soeui, 31.VII–1.VIII.1998 J.C. Ieong leg. (NIBR–0133).

Distribution. Palaearctic [Spain, Iran, Bulgaria]; *South Korea (GB, GG, GN).

4. *Orthocentrus caudalis* Humala & Lee, sp. nov.

http://zoobank.org/47B8B539-5A41-4AA4-A487-7A50E49A04AA

Fig. 3

Description. Female. Fore wing length 3.0 mm.

Face at level of antennal sockets as wide as high; head smooth and polished, face with punctures; eyes not setose; dorsal ridge of face in between antennal sockets without a median prominence; face in profile straight, except just before antennal sockets impressed; edge of clypeus straight, antennal sockets on a shelf; malar space with distinct subocular sulcus which is bent towards occiput; maxillary palp reaching to beyond fore coxa. In dorsal view, head posteriorly concave; temples short; lateral ocellus separated from eye by a distance 1.3 times longer than its maximum diameter; POL 1.3 times as long as diameter of lateral ocellus, lacking ocellar-ocular grooves. Minimum distance between antennal sockets about 0.7× diameter of socket; antenna comparatively short and thick, with 24 flagellomeres (25 in paratype) which gradually shortening apically; first flagellomere 1.5 times as long as wide and about 0.4 times as long as scape; scape nearly parallel-sided.

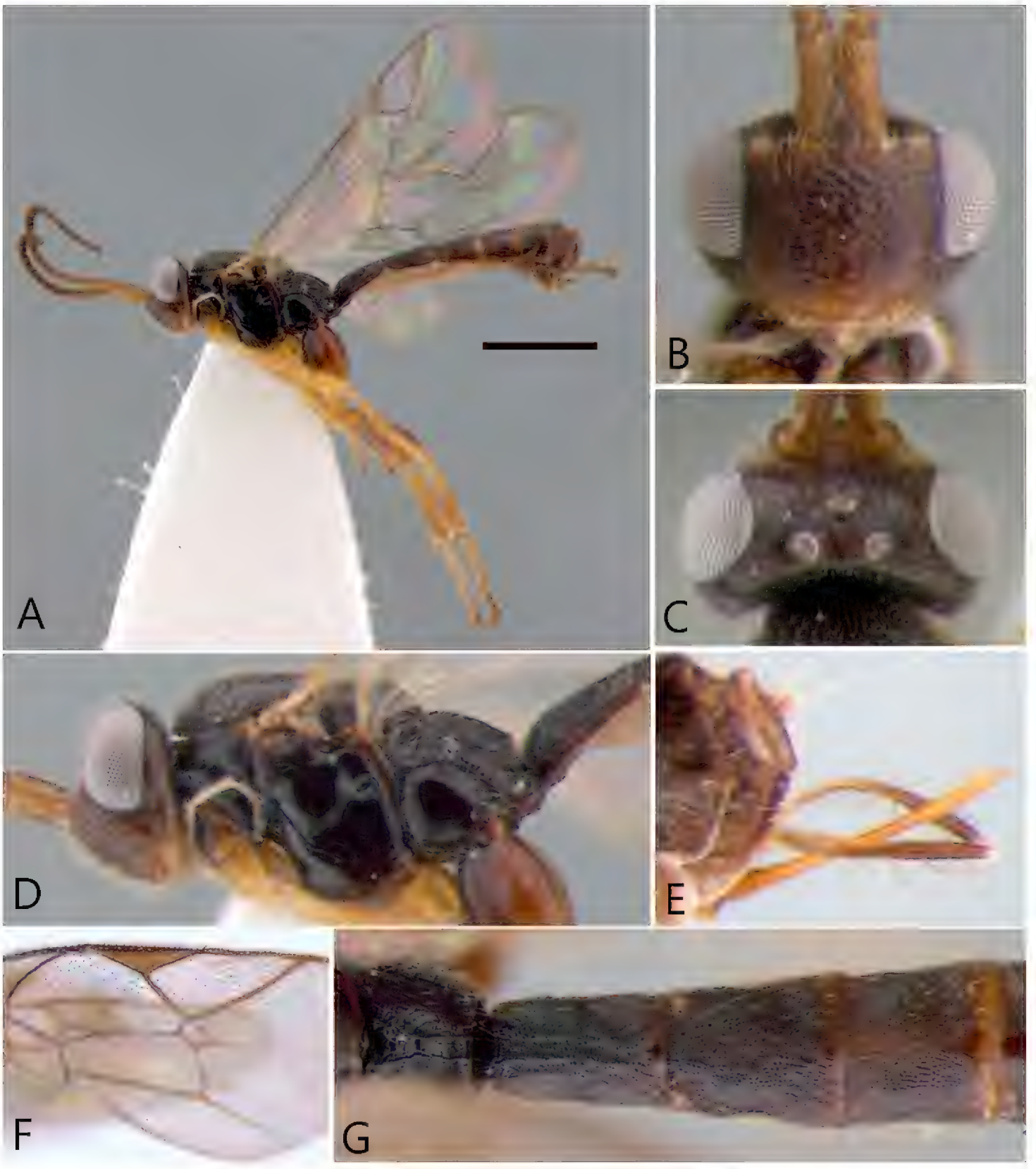

Figure 3. *Orthocentrus caudalis* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** ovipositor **F** areolet **G** propodeum and first to third tergites in dorsal view.

Mesosoma smooth and polished except postero-ventral corner of pronotum with short striae, mesoscutum with indicated notauli; in profile, scutellum weakly convex, metapleuron somewhat convex; propodeum with coriaceous microsculpture and with complete posterior transverse carina, lateromedian longitudinal carinae indistinct basally, spiracle small.

Legs all slightly flattened, broad; coxae and femora polished, tibiae and tarsi coriaceous-granulate; hind femur 3.1 times as long as high, hind tibia 3.6 times as long as apically wide; tibiae dorsally with spine-like setae; spurs curved apically.

Wings not particularly narrow, fore wing with areolet closed but 3rs-m weak, areolet longer than high, vein 2rs-m shorter than 3rs-m, 2m-cu meeting areolet at apical 0.6, vein Rs nearly straight; nervellus intercepted slightly below middle.

First tergite 2.0 times as long as posteriorly wide, in dorsal view, slightly wider at spiracles; coriaceous, with weak lateromedian longitudinal carinae, with transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally. Second tergite 1.2 times as long as posteriorly wide; coriaceous, with shallow transverse impressions originating at about middle of tergite, sloping anteriorly and posteriorly, not meeting clearly centrally; anterior thyridia small, contrastingly coloured. Third tergite coriaceous; remaining tergites smooth and polished; fourth tergite with coriaceous microsculpture antero-medially. Ovipositor slightly upcurved, thin, as long as hind femur, without dorsal notch; ovipositor sheath narrow, pointed, with setae longer than ovipositor sheath width and curved backwards, sparser basally.

Body setose except eyes, pronotum, mesopleuron, metapleuron; setae on propodeum, anterior tergites and posterior sides of coxae very few.

Blackish brown except mouthparts and malar space pale, antenna dull yellow ventrally, infuscate over entire dorsal side. Clypeus apically and dorsal ridge of upper face between antennae narrowly yellowish, frontal orbits with small yellowish marks close to antennal sockets; sternites creamy, fore and mid legs and hind trochanters and trochantellus yellowish. Hind coxae brown in basal 2/3, hind femur brownish, except for more light basal third. Tergites 3 and 4 with light brown apical margin.

Male. Unknown.

Biology. Hosts unknown.

Etymology. Named from the Latin *cauda* (tail) after the unusually long ovipositor as long as the hind femur.

Comparison. This is a distinctive species on account of the very long, thin, slightly upcurved ovipositor, which is as long as the hind femur (Fig. 3A).

Material examined. ***Holotype:*** female; South Korea, **JN**: Gurye-gun, Gurye-eup, Mt. Jirisan National Park, Nogodan, 35°17'47"N, 127°31'36"E, 20.VI–10.IX.2011, J.W. Lee leg. (DNUE).

Paratype: 1 ♀, China, Jirin-seong, Helong-si, Xicheng-jin, Mingyan-chon, 42°32'48"N, 129°00'38"E, 31.VIII–7.IX.2009, J.W. Lee leg. (ZIN).

Distribution. South Korea (JN), China.

5. *Orthocentrus consobrinus* Humala & Lee, sp. nov.

http://zoobank.org/14312A34-3F11-4F96-8D7F-F2225EEC169E

Fig. 4

Description. Female. Fore wing length 4.0 mm.

Face at level of antennal sockets 1.4 times as wide as high; smooth, polished, slightly punctate; eyes not setose; dorsal ridge of face inbetween antennal sockets with a low median blunt prominence; face profile straight except dorsally very slightly im-

pressed; inner orbits divergent ventrally; edge of clypeus straight, antennal sockets not on a distinct high shelf; subocular sulcus distinct, sharp, slightly bent towards occiput; maxillary palp reaching beyond fore coxa. In dorsal view, head posteriorly moderately concave, temples short but distinct, lateral ocellus separated from eye by its maximum diameter, POL 1.1 times as long as diameter of lateral ocellus; ocellar-ocular grooves present. Minimum distance between antennal sockets about 0.8× diameter of socket; antenna short, with 21 flagellomeres elongate, gradually shortening towards apex of antenna; first flagellomere 1.8 times as long as wide and about half of the scape length; scape slightly convex on inner surface, slightly concave on outer surface.

Mesosoma smooth and polished; mesoscutum anteriorly with distinct notauli; in profile, scutellum weakly convex, metapleuron slightly convex; propodeum with posterior transverse carina complete, strong and raised between lateral longitudinal carinae, lateromedian longitudinal carinae complete, lateral longitudinal carinae distinct, spiracle small.

Legs robust; coxae polished, femora with coriaceous microsculpture, tibiae and tarsi coriaceous-granulate; hind femur 2.7 times as long as high, hind tibia 4.0 times as long as apically wide; tibiae with spine-like setae.

Wings not particularly narrow; fore wing with small narrow areolet, vein Rs straight posteriorly, vein cu-a opposite Rs&M, oblique; nervellus straight, intercepted below.

First tergite slightly widening posteriorly, 1.5 times as long as apically wide; coriaceous, with two indistinct lateromedian longitudinal carinae and indistinct longitudinal striae, with transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally.

Second tergite as long as posteriorly wide; coriaceous and longitudinally striate, anterior corners impressed and transverse groove near posterior margin bending anteriorly near lateral margins, forming a somewhat uplifted area medially; small thyridia rounded. Remainder of metasoma unsculptured, polished; third tergite with coriaceous microsculpture anteriorly. Ovipositor comparatively thin, slightly upcurved, without subapical dorsal notch; ovipositor sheath narrow, with sparse setae.

Body setose except eyes, pronotum, mesopleuron and metapleuron, setae scattered on metasoma and posterior sides of coxae.

Blackish brown; face brown, yellowish along upper margin, inner orbits broadly light yellow from centre of face to level of front ocellus, antenna proximally and ventrally yellowish; malar area yellowish posterior to malar sulcus and up to level of ventral edge of eye; mouthparts, fore and mid coxae, all trochanters and trochantelli yellowish brown, remainder of fore and mid legs orange; hind legs slightly darker, apical margin of second tergite light brown.

Male. Unknown.

Biology. Hosts unknown.

Etymology. Named from the Latin *consobrinus* (relative), after the conspicuous similarity to *O. koreanus*.

Comparison. Compared with the other species that have a lenticular head, flattened and smooth face, short temples, and eyes glabrous, the fore wing areolet is present, unlike

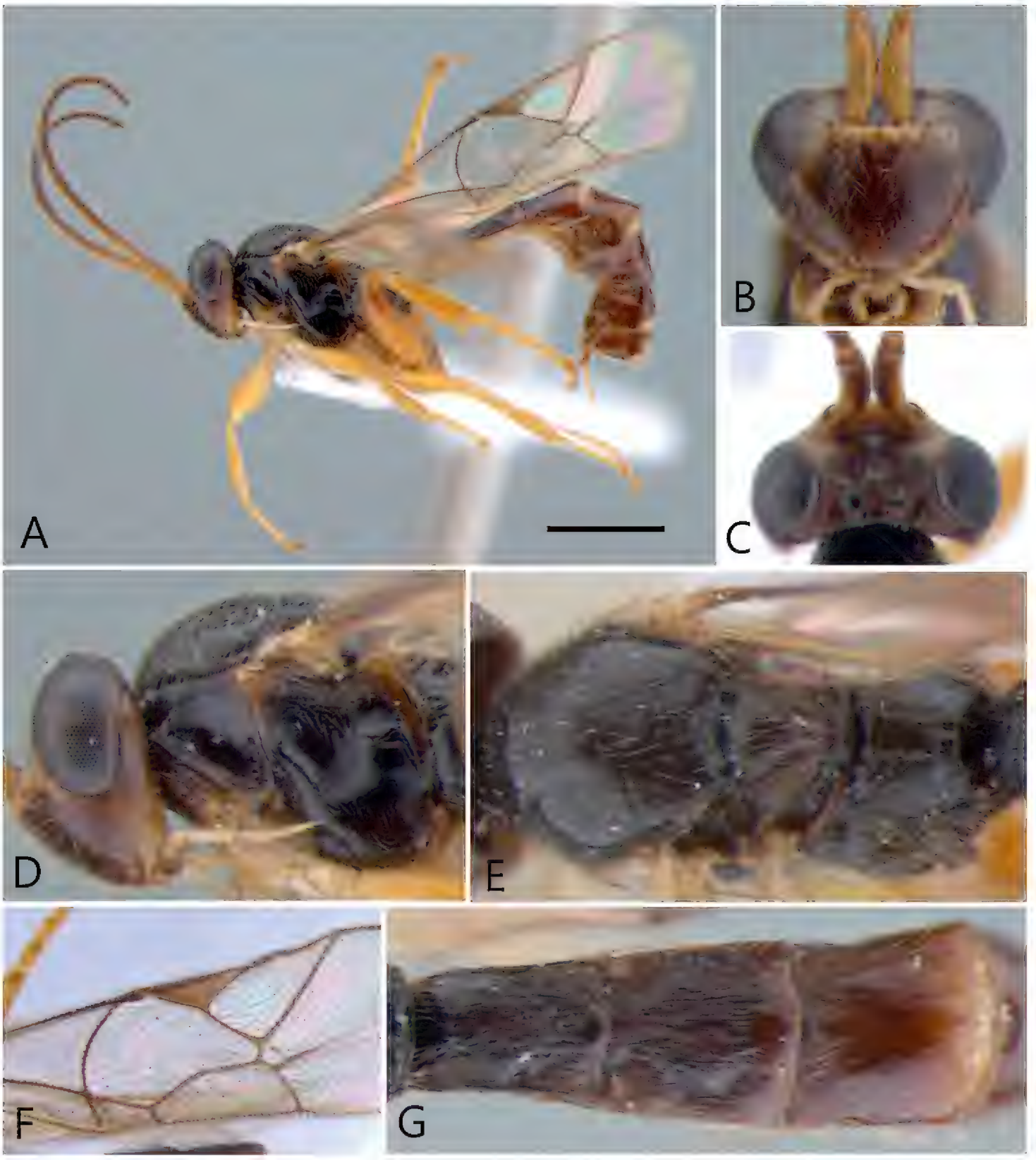

Figure 4. *Orthocentrus consobrinus* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** areolet **G** first to third tergites in dorsal view.

in *O. brachycerus* and *O. leei*. From the allied *O. koreanus* it differs in the brown face, smaller number of antennal flagellomeres and the first tergite 1.5 times as long as apically wide.

Material examined. ***Holotype:*** female; South Korea, **GW,** Mt. Taebaeksan, 14.V–20.VI.1999, D.S. Ku leg. (NIAS).

Paratype: 1♀, Russia, Primorsky Terr., Vladivostok, Sedanka, 100 m, 17.V.2016, S. Belokobylskij leg. (ZIN).

Distribution. South Korea (GW), Russia (Primorsky Terr.).

6. *Orthocentrus flavescens* Humala & Lee, sp. nov.

http://zoobank.org/5182E1AA-288D-46E3-9F0D-356A13F6BB5D

Fig. 5

Description. Female. Fore wing length 3.1 mm.

Face at level of antennal sockets 1.4 times as wide as high; face smooth, polished, sparsely punctate, eyes not setose, dorsal ridge of face in between antennal sockets with a median blunt low prominence; face profile straight except dorsally very slightly impressed, inner orbits slightly divergent ventrally; edge of clypeus straight, antennal sockets not on a distinct high shelf; subocular sulcus well developed, nearly straight; maxillary palp reaching beyond fore coxa. In dorsal view, head posteriorly slightly concave, temples very short, lateral ocellus separated from eye by a distance 1.4 times longer than its maximum diameter, POL 1.6 times as long as diameter of lateral ocellus; ocellar-ocular grooves present. Minimum distance between antennal sockets about 0.4× diameter of socket; antenna with 20 flagellomeres elongate, first flagellomere about 3.0 times as long as wide and about 0.9 times as long as scape; scape slightly convex on inner surface, slightly concave on outer surface.

Mesosoma smooth and polished; mesoscutum anteriorly with distinct notauli; in profile, scutellum particularly high, metapleuron slightly convex; propodeum with posterior transverse carina complete, strong and raised between lateral longitudinal carinae, lateromedian longitudinal carinae complete, lateral longitudinal carinae distinct, spiracle small.

Legs robust; coxae polished, femora with coriaceous microsculpture, tibiae and tarsi coriaceous-granulate; hind femur 2.9 times as long as high, hind tibia 3.5 times as long as apically wide; tibiae with spine-like setae.

Wings not particularly narrow; fore wing without areolet; vein Rs nearly straight, fore wing with vein Rs+2r meeting middle of pterostigma; vein cu-a nearly interstitial (opposite Rs&M); nervellus straight, intercepted below.

First tergite stout, widening posteriorly, 1.2 times as long as posteriorly wide; coriaceous, with two lateromedian longitudinal carinae and longitudinal striae, with transverse impressions originating at about middle of tergite, sloping posteriorly, meeting centrally.

Second tergite 0.8 times as long as posteriorly wide; coriaceous and longitudinally striate, with developed lateromedian longitudinal carinae, anterior corners impressed and transverse groove near posterior margin bending anteriorly near lateral margins, forming a somewhat uplifted striated area medially; small thyridia contrastingly coloured. Third tergite longitudinally striate with transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally. Remainder of metasoma unsculptured, polished. Ovipositor thin, comparatively short, weakly upcurved, without subapical dorsal notch; ovipositor sheath narrow, with sparse setae.

Body setose except eyes, pronotum, mesopleuron and metapleuron, setae scattered on metasoma and posterior sides of coxae.

Yellowish brown; face dusky orange, inner orbits broadly yellow up to occiput; antenna yellowish-brown; malar area yellow posterior to subocular sulcus and up to level of eye middle; mouthparts, legs yellow; propleuron, pronotum, mesopleuron in lower 2/3,

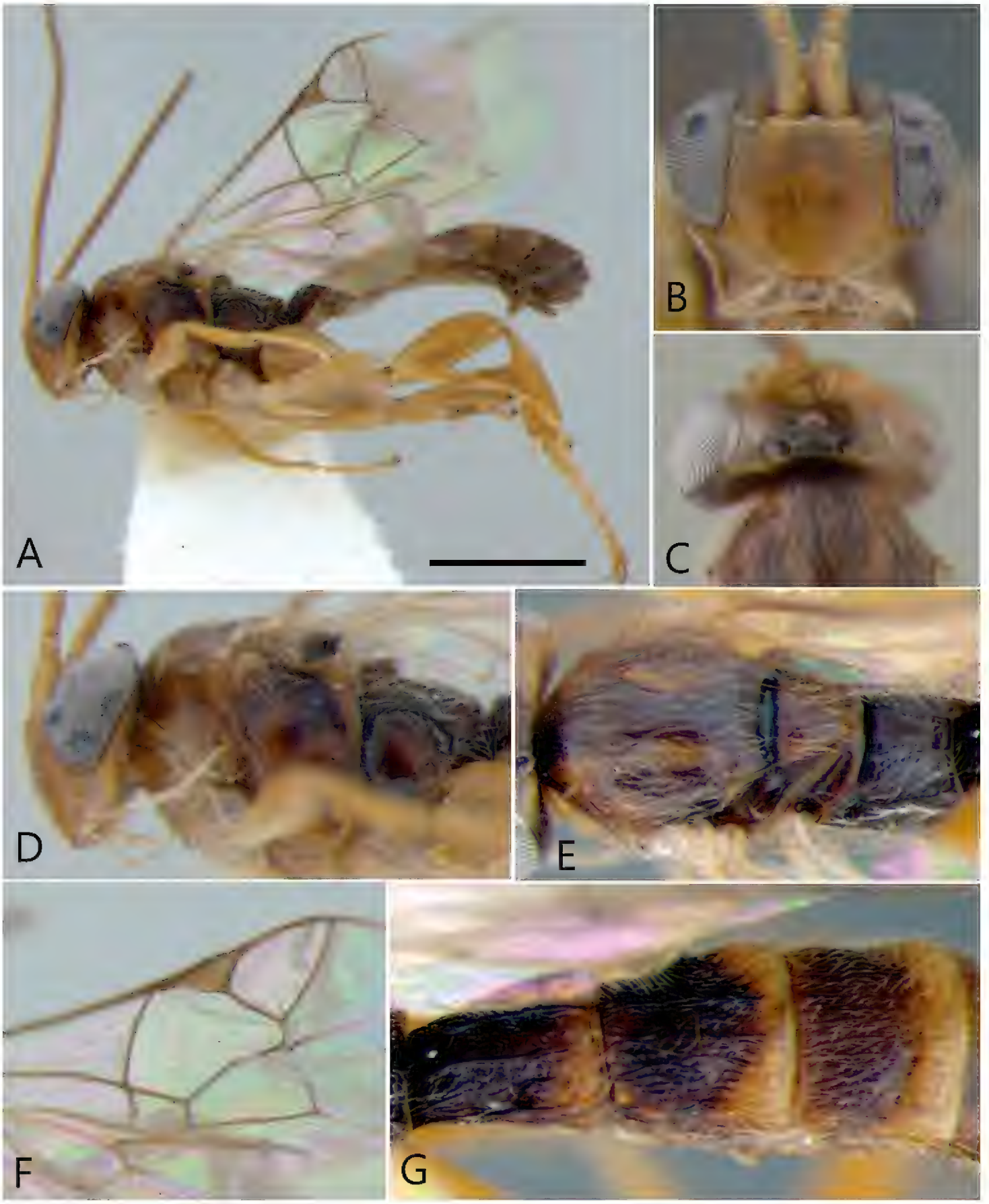

Figure 5. *Orthocentrus flavescens* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** areolet **G** first to third tergites in dorsal view.

mesoscutum anteriorly and longitudinal bars along notauli, scutellum, central part of metapleuron, reddish brown; posterior margins of tergites 1–3 and tergite 4 light-brown.

Male. flagellum with 21 flagellomeres; basic coloration – yellow, frons reddish-yellow. Otherwise as in female.

Biology. Hosts unknown.

Etymology. Named from the Latin *flavesco* (turn yellow) after the yellowish general body colouration.

Comparison. This is a distinctive species on account of the metasomal tergites 2–3 with strong transverse-diagonal furrows separating contrastingly coloured creamy latero-posterior corners. From the closely allied *O. castellanus* it differs in the absence of the fore wing areolet and fewer antennal flagellomeres.

Material examined. ***Holotype:*** female; South Korea, **GW**: Chuncheon-si, Sanong-dong, Gwangwon Provincial Arboretum, 1–14.VIII.2013, I.G. Kim leg. (DNUE).

Paratype: South Korea, **GB**: 1 ♂, Bongjeongsa 10–11.VII.1998, J.W. Lee leg. (DNUE–0135).

Distribution. South Korea (GB, GW).

7. *Orthocentrus fulvipes* Gravenhorst, 1829

Figs 1E, F

Biology. Hosts unknown.

Comments. This is the commonest species of the genus in Korea.

Material examined. South Korea, **GG**: 1♀, Seoul, Cheongyangri-dong, Dongdaemun-gu, MTI, S.N.U. 11–18.VII.2005, W.I. Choi leg., (DNUE–0247); **CB**: 1♀, Eumseong-gun, Eumseong-eup, Mt. Gayeopsan, 36°57'44"N, 127°40'52"E, 24.VII.2013, J.K. Choi leg. (DNUE–0495); 1♂, Boeun-gun, Naesongni-myeon (01), Sinwon-ri, 36°30'41"N, 127°53'26"E, 20.VII.2007, E.J. Hong, Y.R. Jeon & S.K. Lee leg. (DNUE–0275); **CN**: 1♀, Daejeon, Donggu, Daejeon University, MT, 8.X–30XI.2007, J.W. Lee leg. (DNUE–0130); **GB**: 1♀, Gyeongsan-si Dae-dong, Yeungnam University 35°49'N, 128°45'E, 3.VIII.1989, J.W. Lee leg. (DNUE–0115); 2♀, Gyeongsan-si Dae-dong, Yeungnam University 35°58'N, 128°47'E, 20–27.V.2013, J.W. Lee leg. (DNUE–0393,0394); 1♀, Gyeongsan-si Dae-dong, Yeungnam University, 31.VII.1986. S.M. Ryu leg. (DNUE–0139); 1♀, Youngyang-gan, Subi-myeon, Sinwon-ri, 18.V.2001, J.W. Lee leg. (DNUE–0338); 1♂, Gyeongsan-si Dae-dong, Yeungnam University 10.VII.1986. J.W.Lee leg. (DNUE–0138); 3♂, Mungyeong-si Mungyeong-eup Sancho-ri, 14.VIII.1982, J.W. Lee leg. (DNUE–0159,0163,0162); **GG**: Pocheon-si, Soheul-eup, Jikdong-ri, Korean National Arboretum, Gwangneung Forest MTII, 37-45-22 N 127-9-48.9 E, 123 m, 15.vii-2.viii.2013, S.Y. Park, J.O. Lim & J.S. Lim leg. (NIBR); **GW**: 1♀, Chuncheon-si, Sanong-dong, Arboretum, 15–30.V.2013, I.G. Kim leg. (ZIN); 1♀, Chuncheon-si, Sanong-dong, Arboretum, 81 m, 2–15.V.2012, G. Yeong Lee leg. (DNUE–0558); China: 1♀, Jilin-seong, Helong-si, Xicheng-jin, Mingyan-chon, 42°32'48"N, 129°00'38"E, 25–31.VIII.2009, J.W. Lee leg. (DNUE–0227); 1♀, Jirin-seong, Helong-si, Xicheng-jin, Mingyan-chon, 42°32'48"N, 129°00'38"E, 31.VIII–7.IX.2009, J.W. Lee leg. (DNUE–0504); Japan: 1♀,2♂, Hokkaido University, Kita 8, Nishi 5, Kita-ku, Sapporo, Hokkaido, 30.VII–21.VIII.2013, S.H. Oh leg. (DNUE–0056, 0047, 0052).

Distribution. Palaearctic, Oriental; China, Japan; *South Korea (CB, CN, GB, GG, GW).

8. *Orthocentrus hirsutor* Aubert, 1969
Figs 6A, B

Biology. Hosts unknown.

Material examined. 1 ♀ South Korea, **GB**: Yeongju-si, Punggi-eup, Jungyeong (site 104), MT, 22.VI–3.VII.2009, C.J. Kim leg. (DNUE).

Distribution. Palaearctic; *South Korea (GB).

9. *Orthocentrus koreanus* Humala & Lee, sp. nov.
http://zoobank.org/04EAD2D7-DDE8-4B8B-B539-05BC080726D7
Fig. 7

Description. Female. Fore wing length 3.7 mm.

Face at level of antennal sockets as wide as high; face smooth, polished, slightly punctate, frons finely pustulate with hairs, temples with fine matt-like coriaceous sculpture; eyes not setose, face slightly prominent, inner orbits slightly divergent ventrally; dorsal ridge of face in between antennal sockets without a median prominence; profile straight except dorsal third slightly impressed, edge of clypeus straight, antennal sockets on a shelf; subocular sulcus distinct, slightly bent towards occiput; labial palp short; maxillary palp reaching slightly beyond fore coxa. In dorsal view, head posteriorly slightly concave, temples short, lateral ocellus distant from eye by its maximum diameter; POL 1.4 times as long as diameter of lateral ocellus; ocellar-ocular groove somewhat developed. Minimum distance between antennal sockets about 2/3 diameter of socket; antenna with 26–27 elongate flagellomeres (n=18) which gradually shorten apically; basal flagellomere 2.0 times as long as wide and about half of scape length; scape slightly convex on inner surface, slightly concave on outer surface.

Mesosoma smooth and polished; mesoscutum with distinct notauli anteriorly indicated; in profile, scutellum somewhat high, metapleuron slightly convex; propodeum with posterior transverse carina present between lateral longitudinal carinae and pleural carina, area superomedia narrowed posteriorly, spiracle medium-sized.

Legs stout, slightly flattened, rather broad; coxae polished, femora polished-coriaceous, tibiae and tarsi coriaceous-granulate; hind femur 2.9–3.0 times as long as high, hind tibia 3.7 times as long as apically wide; tibiae with spine-like setae.

Wings not particularly narrow; fore wing with vein Rs+2r meeting centre of pterostigma; areolet closed, small, almost petiolate, 2m-cu meeting areolet at apical 0.7, vein Rs bent towards wing apex; vein cu-a inclivous and slightly distad of Rs&M; nervellus intercepted in lower third.

First metasomal tergite elongate, slightly widening apically, 2.1 times as long as posteriorly wide, coriaceous-rugose, with two nearly parallel, complete or posteriorly almost complete lateromedian longitudinal carinae; with deep transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally. Second tergite 1.3 times as long as posteriorly wide, coriaceous-rugose and somewhat

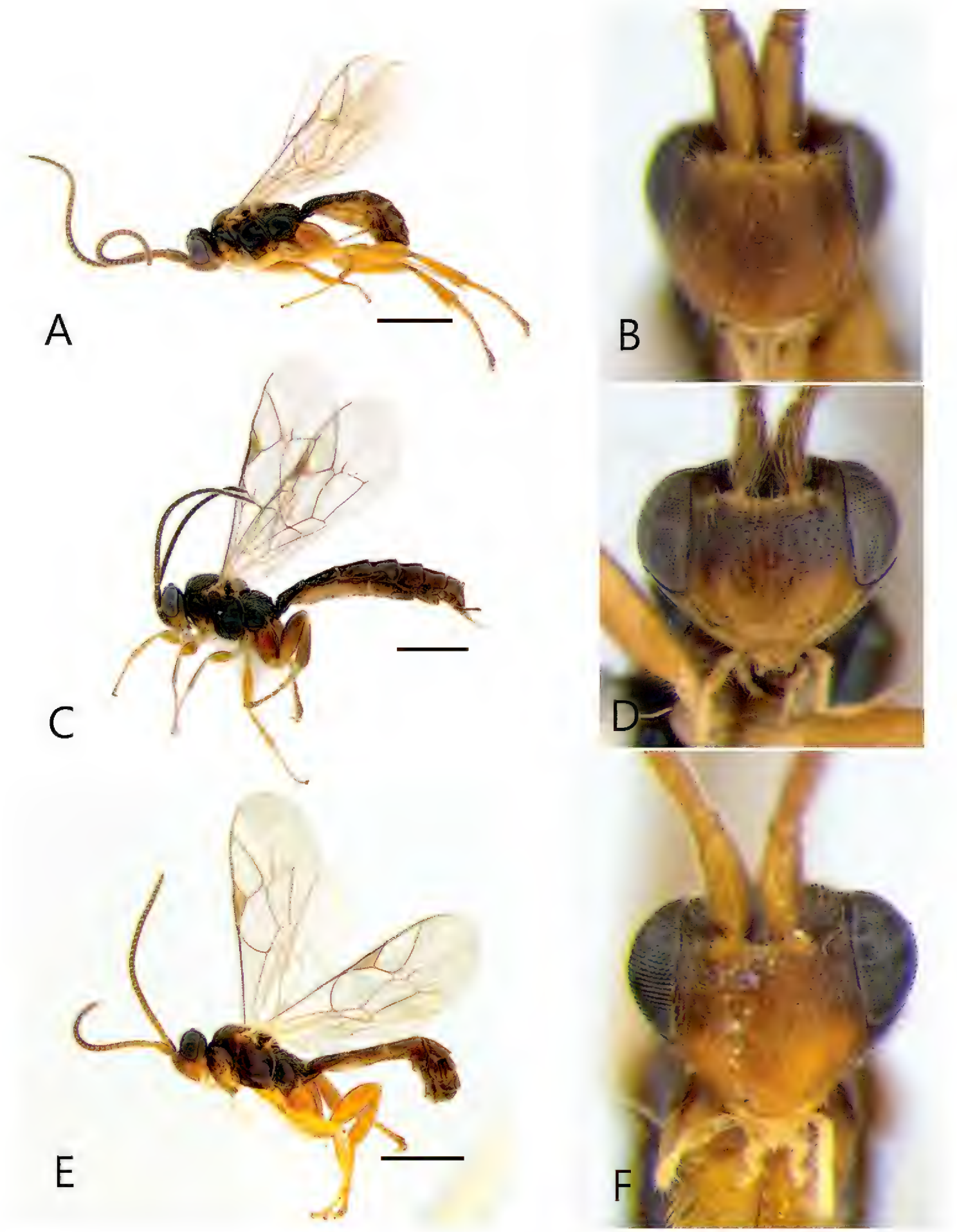

Figure 6. *Orthocentrus* spp. **A** Habitus in lateral view of *O. hirsutor* **B** head in frontal view of *O. hirsutor* **C** habitus in lateral view of *O. marginatus* **D** head in frontal view of *O. marginatus* **E** habitus in lateral view of *O. patulus* **F** head in frontal view of *O. patulus*.

strigose; with the central area convex, bounded by well-defined anterolateral oblique furrows connected with posterior transverse impressions originating at about middle of tergite and meeting centrally; thyridia small, oval, contrastingly coloured. Third ter-

gite slightly coriaceous anteriorly, all remaining tergites smooth and polished. Ovipositor slightly upcurved, thin, without dorsal notch; ovipositor sheath narrow, pointed, with long scarce setae.

Body setose except eyes, propleuron, hind corner of pronotum, mesopleuron and metapleuron; setae very scattered on propodeum, tergites and posterior coxae.

Brown to dark brown except face, frontal orbits, malar space, lower temple, hind corner of pronotum, tegula, wing bases, fore and mid legs, narrow apical bands on tergites 2 and 3; hind trochanter and trochantellus and base of hind tibia yellowish brown, mouthparts and sternites creamy. Sometimes face infuscate laterally. Hind coxa apically yellowish-brown.

Male. Unknown.

Biology. Hosts unknown.

Etymology. Named after the type locality, Korea.

Comparison. Compared with the other species that have a lenticular head, flattened and smooth face, short temples, and eyes glabrous, *O. koreanus* has the fore wing areolet closed and 26–27 antennal flagellomeres, unlike in *O. brachycerus* and *O. leei*. From the allied *O. consobrinus* it differs in the yellowish face, more antennal flagellomeres and the first tergite 2.1 times as long as posteriorly wide.

Material examined. ***Holotype:*** female; South Korea, **GW**: Pyeong-chang-gun Yong-pyeong-myeon Gyebangsan, 28.VI–12.VIII.2012, J.Y. Park leg. (DNUE–0430).

Paratypes: South Korea, **CN**: 1♀, Daejeon, Donggu, Daejeon University, MT, 12.IV–12.V.2007, J.W. Lee leg. (ZIN–0137); **GB:** 1♀, Cheongdo-gun, Unmun-myeon, Mt. Unmun (U2), 35°38'50"N, 128°58'19"E, MT, 30.V–16.VI.2009, C.J. Kim leg. (DNUE); 1♀, Cheongdo-gun, Unmun-myeon, Mt. Unmun 23.V.2008, J.W. Lee leg. (DNUE–0418); 1♀, Mungyeong-si, Gaeun-eup, Wanjang-ri, Mt. Songnisan National Park, Beorimigijae, 36°40'59"N, 127°57'07"E, MT, 17.VII–12.VIII.2013, J.K. Choi leg. (DNUE–0083); 1♀, Chilgok-gun, Dongmyeong-myeon, Hakmyeong-ri, Gansansaseong, 36°02'11.7"N, 128°34'18.17"E, MT, 10.VI–1.VII.2015, J.W. Lee leg. (ZIN); 1♀, **GW**: Donghae-si, Samhwa-dong, Mureung valley, MT, 21–30.V.2005, J.W. Lee leg. (ZIN–0472); 1♀, Donghae-si, Samhwa-dong, Mureung valley, 35°31'N, 126°53'E, MT, 28.VIII–9. IX.2006, K.B. Kim leg. (DNUE); 1♀, Donghae-si, Samhwa-dong, Mureunggyegok, 37°25'45"N, 126°01'17"E, MT, 31.V–5.VI.2005, J.W. Lee leg. (DNUE–0244); 1♀, Wonju-si, Panbu-myeon, Mt. Bangtaesan, MT, 30.VII–28.VIII.2013, J.W. Lee leg. (DNUE–0473); 1♀, Mt. Taebaeksan, MT, 14.V–20.VI.1999, D.S. Ku (NIAS); 5♀, Mt. Taebaeksan, Yuilsa, MT, 20.VI–11.VII.1999, D.S. Ku leg. (NIAS); **JB**: 1♀, Muju-gun, Mupung-myeon, Hyeonnae-ri, San3, Mt. Bakseoksan, 35°59'2.79"N, 127°52'30.74"E, 17.VI–2.VII.2015 J.W. Lee leg. (DNUE); 1♀, Jeongeup-si, Naejang-dong Naejang-san National Park, Geumseongyegok (14 site), MT, 8–14.VI.2008, J.W. Lee leg. (DNUE–0343); **JJ**: 1♀, Jeju-si, Yeon-dong, Halla Arboretum, MT, 1–16.V.2012, S.H. Jeong leg. (DNUE–0039); 1♀, Jeju-si, Jejudaehak-ro, Cheju National University, 33°27'21"N, 126°33'38"E, MT, 19–26.V.2008, J.W. Lee leg. (DNUE–0251).

Distribution. South Korea (CN, GB, GW, JB, JJ).

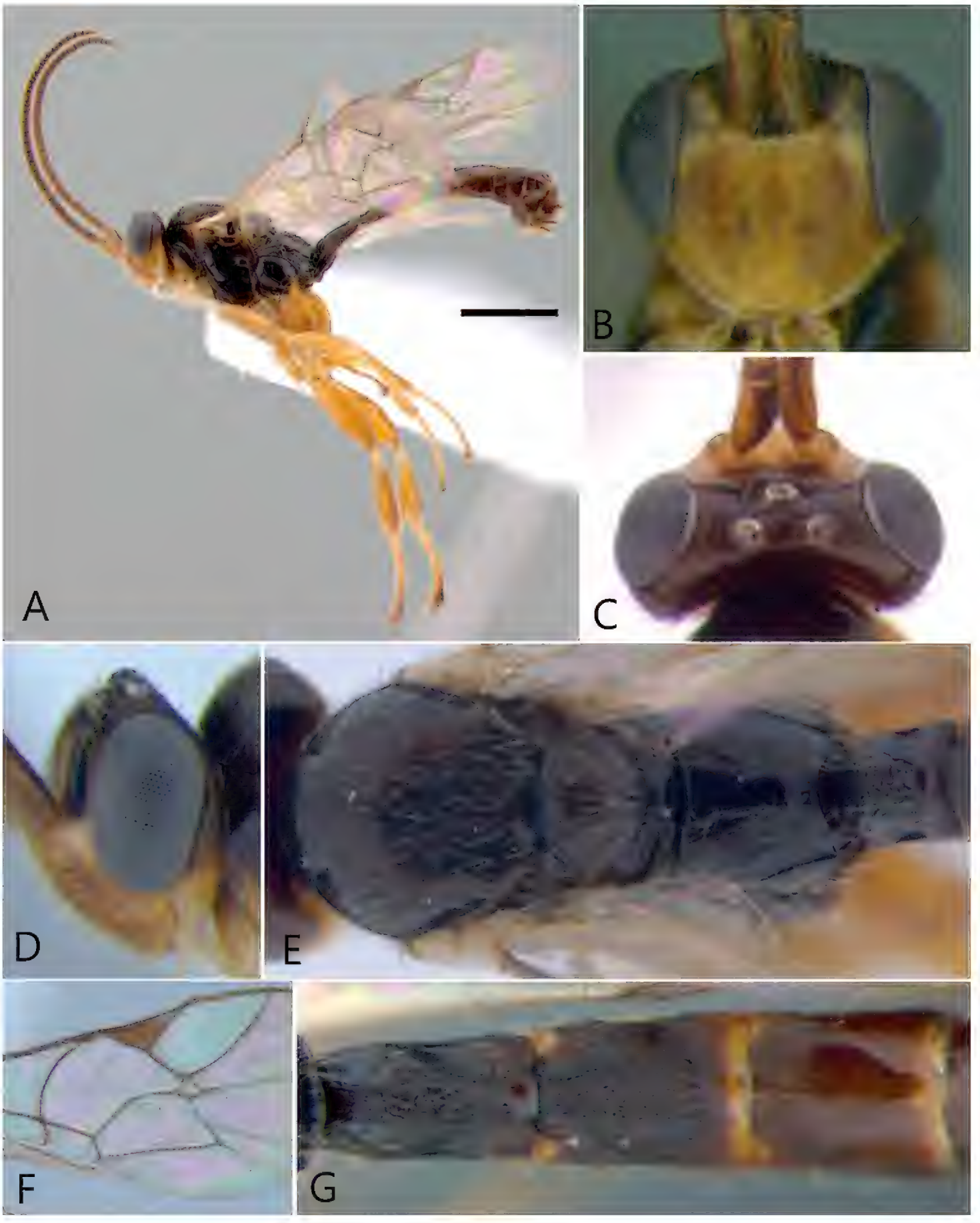

Figure 7. *Orthocentrus koreanus* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head in lateral view **E** mesosoma in dorsal view **F** areolet **G** first to third tergites in dorsal view.

10. *Orthocentrus leei* Humala & Choi, sp. nov.

http://zoobank.org/24556892-5675-4781-978D-F79A4D583427

Fig. 8

Description. Female. Fore wing length 2.9 mm.

Face at level of antennal sockets 1.4 times as wide as high; face smooth, polished, slightly punctate, eyes not setose, dorsal ridge of face in between antennal sockets with a median blunt low prominence; face profile straight except dorsally very slightly impressed, inner orbits divergent ventrally; edge of clypeus straight, antennal sockets not on a distinct high shelf; subocular sulcus distinct, gently bent towards occiput; maxillary palp reaching to fore coxa. In dorsal view, head posteriorly concave, temples short but distinct, lateral ocellus separated from eye by its maximum diameter, POL 1.2–1.5 times as long as diameter of lateral ocellus; ocellar-ocular grooves present. Minimum distance between antennal sockets about 0.6× diameter of socket; antenna short, with 18–20 flagellomeres gradually shortening towards apex of antenna; first flagellomere 1.7 times as wide as high and about half of length of scape; scape slightly convex on inner surface, slightly concave on outer surface.

Mesosoma smooth and polished; mesoscutum anteriorly with distinct notauli; in profile, scutellum weakly convex, metapleuron slightly convex; propodeum with posterior transverse carina complete, strong and raised between lateral longitudinal carinae; lateromedian longitudinal carinae complete, lateral longitudinal carinae distinct, spiracle small.

Legs robust; coxae and femora polished, femora partly with coriaceous microsculpture, tibiae and tarsi coriaceous-granulate; hind femur 2.7 times as long as high, hind tibia 3.3 times as long as apically wide; tibiae with spine-like setae.

Wings not particularly narrow; fore wing without areolet; vein Rs nearly straight, fore wing with vein Rs+2r meeting pterostigma at basal 0.45; vein cu-a slightly distad of Rs&M; nervellus intercepted below.

First tergite slightly widening posteriorly, 1.5 times as long as posteriorly wide; coriaceous, with two lateromedian longitudinal carinae and longitudinal striae, with transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally. Second tergite 0.9 times as long as posteriorly wide; coriaceous and longitudinally striate, anterior corners impressed and transverse groove near posterior margin bent anteriorly near lateral margins, forming a somewhat uplifted area medially; thyridia rounded and contrastingly coloured. Third tergite with anterior thyridia and coriaceous microsculpture in anterior half. Remainder of metasoma unsculptured, polished; Ovipositor comparatively thin, slightly upcurved, with shallow subapical notch; sheath narrow, with setae directed backward.

Body setose except eyes, pronotum, mesopleuron and metapleuron, setae scattered on metasoma and posterior sides of coxae.

Blackish brown; face brown, inner orbits with small yellowish marks close to antennal sockets; clypeus and upper face, antenna orange; malar area posterior to malar sulcus yellowish; mouthparts whitish-yellow, fore and mid legs yellow; hind legs dull orange, hind coxa dark brown in basal 3/4, hind femur somewhat infuscate centrally; posterior margin of tergite 2 and tergite 3 anteriorly and posteriorly yellowish-brown; sternites creamy.

Male. Unknown.

Biology. Hosts unknown.

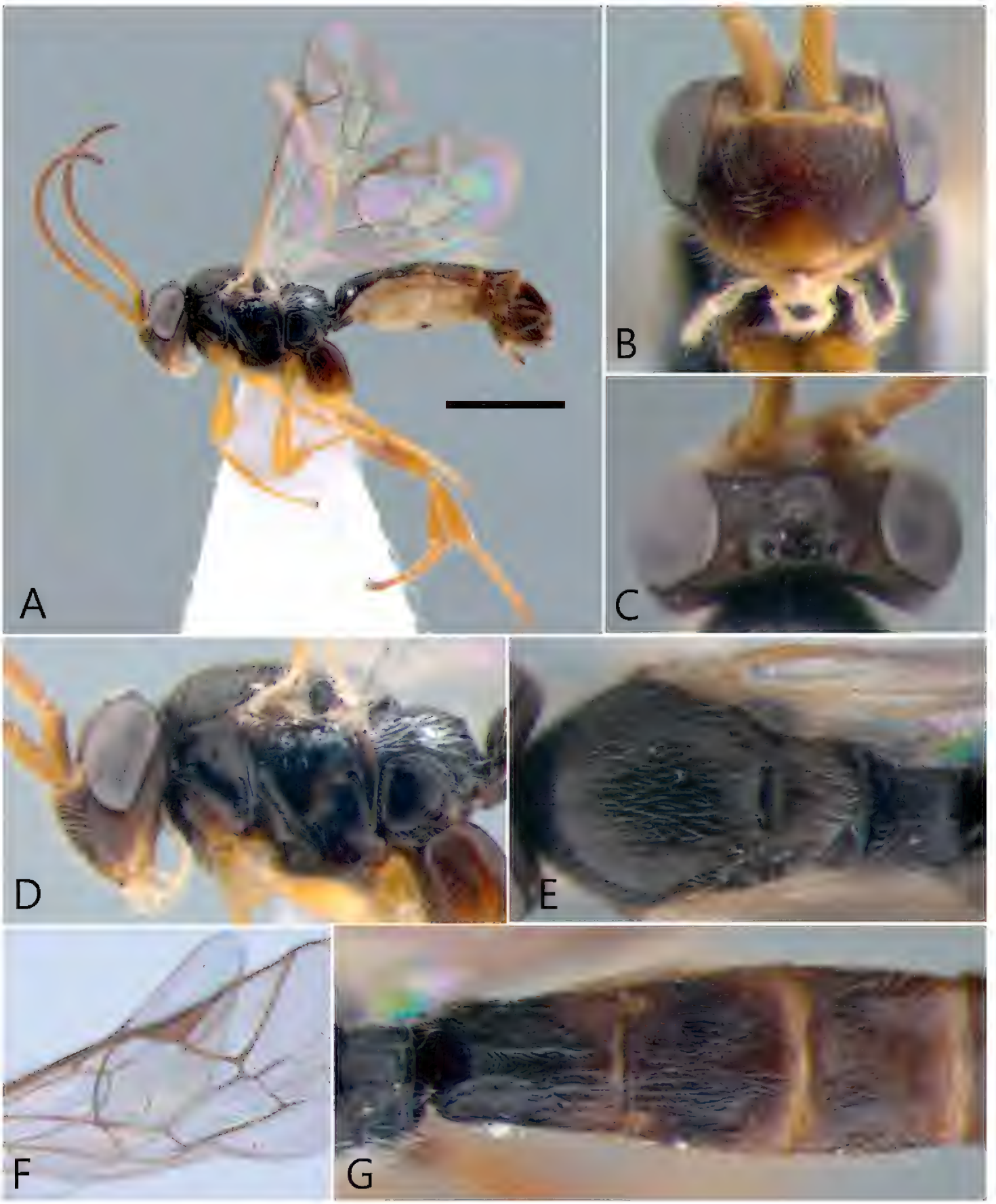

Figure 8. *Orthocentrus leei* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** areolet **G** first to third tergites in dorsal view.

Etymology. This species is named in honor of Professor Jong-Wook Lee, a Korean expert on Ichneumonidae and Head of the Animal Systematic Laboratory of Yeungnam University.

Comparison. Compared with the other species that have a lenticular head, flattened and smooth face, short temples, and eyes glabrous, the fore wing areolet is absent

and the flagellum has fewer than 20 flagellomeres, unlike in *O. koreanus* and *O. consobrinus*. From the allied *O. brachycerus* it differs in the fuscous face and frontal orbits with small yellowish marks, and the POL 1.1 times as long as the diameter of an ocellus.

Material examined. ***Holotype:*** female; South Korea **GG**: Pocheon-si, Soheur-eup, Jikdong-ri, 51–7, Korean National Arboretum, 37°45'1.9"N, 127°08'34.4"E, MT 4, 24.VII–5.VIII.2013, I.G. Kim leg. (DNUE).

Paratype: South Korea, **CB**: 1♀, Geoisan-gun, Chilseong-myeon, Gallon-ri, Gallon valley, 36°43'51.72"N, 127°51'48.89"E, 22.VII–27.X.2011, J.W. Lee leg. (DNUE).

Distribution. South Korea (CB, GG).

11. *Orthocentrus leucostomus* Humala & Lee, sp. nov.

http://zoobank.org/D67B39AA-91FF-4FE3-B067-0BDE87229EBC

Fig. 9

Description. Female. Fore wing length 2.7 mm.

Face at level of antennal sockets as wide as high; head smooth and polished, face granulate, eyes not setose, dorsal ridge of face in between antennal sockets without a median prominence; face profile straight except just before antennal sockets impressed, edge of clypeus straight, antennal sockets on a shelf; malar space with narrow, almost straight subocular sulcus; maxillary palp reaching to beyond fore coxa. In dorsal view, head posteriorly concave, temples short, lateral ocellus distant from eye by a distance 1.1 times longer than its maximum diameter, POL 1.1 times as long as diameter of lateral ocellus, lacking ocellar-ocular grooves. Minimum distance between antennal sockets about 0.4× diameter of socket; antenna comparatively short and thick, with 22 flagellomeres (n = 3) which gradually shorten apically; first flagellomere about 2.0 times as long as wide and about 0.6 times as long as scape; scape nearly parallel-sided.

Mesosoma smooth and polished except postero-ventral corner of pronotum with short striae, mesoscutum with indicated notauli; in profile, scutellum weakly convex, metapleuron convex; propodeum with coriaceous microsculpture and with complete posterior transverse carina, lateromedian longitudinal and lateral longitudinal carinae; spiracle small.

Legs slightly flattened, broad; coxae and femora polished, tibiae and tarsi coriaceous-granulate; hind femur 3.1 times as long as high, hind tibia 3.6 times as long as apically wide; tibiae dorsally with spine-like setae; spurs curved apically.

Wings not particularly narrow, fore wing with narrowly sessile areolet, vein 3rs-m weak, areolet not longer than high, 2rs-m shorter than 3rs-m, 2m-cu meeting areolet at apical 0.6–0.7, nervellus intercepted below middle.

First tergite 1.8 times as long as posteriorly wide, in dorsal view, slightly wider at spiracles; coriaceous, with lateromedian longitudinal carinae, with weak transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally. Second tergite 1.3 times as long as posteriorly wide; coriaceous with dense striae, polished posteriorly, transverse impressions originating at about middle of tergite, sloping anteriorly and posteriorly, not meeting clearly centrally; anterior thyridia

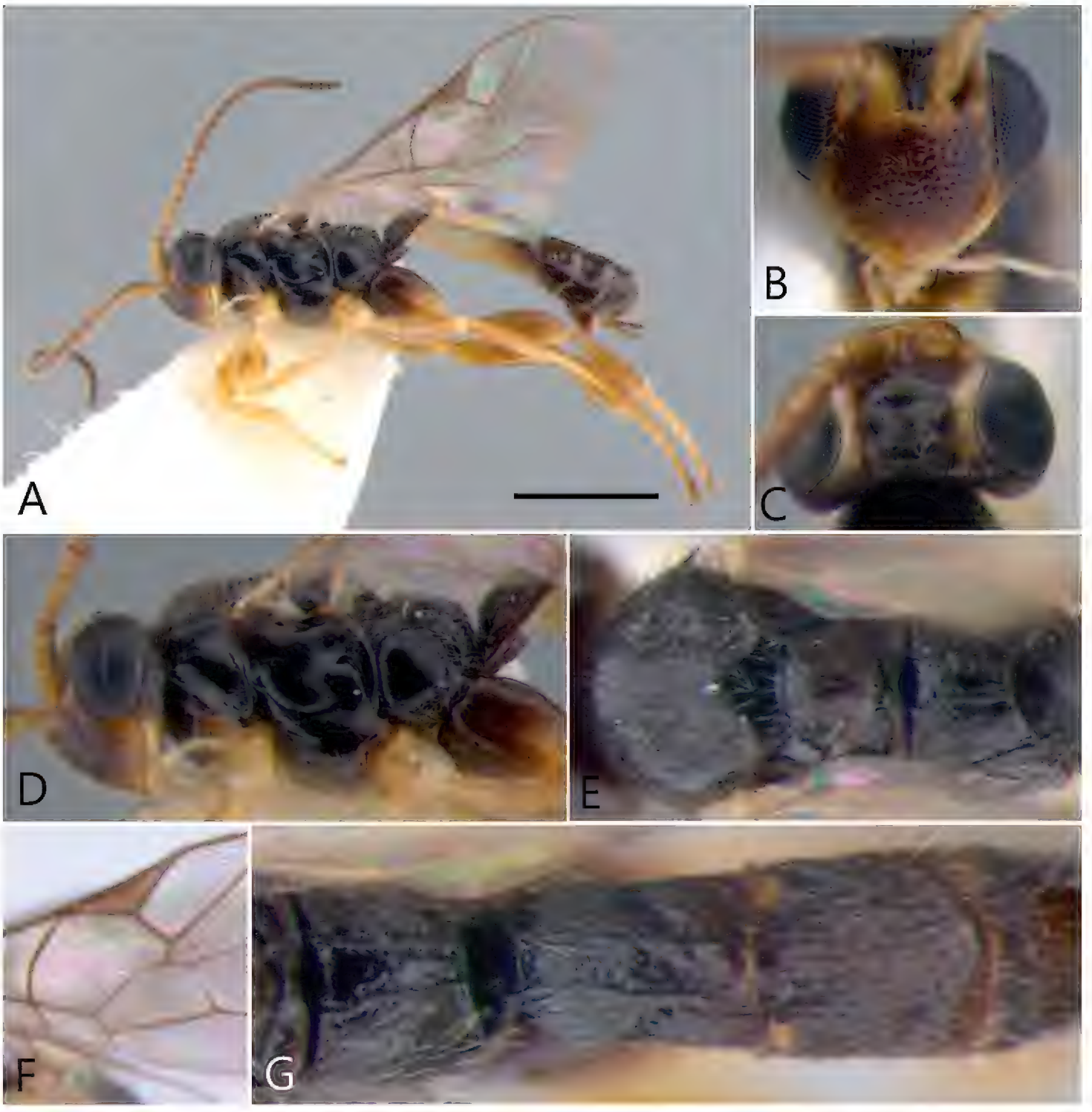

Figure 9. *Orthocentrus leucostomus* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** areolet **G** propodeum and first to second tergites in dorsal view.

rounded, contrastingly coloured. Remaining tergites smooth and polished; third tergite with coriaceous microsculpture antero-medially. Ovipositor straight, thin, comparatively long, without dorsal notch; ovipositor sheath narrow, pointed, with setae longer than sheath width and slightly curved backwards.

Body setose except eyes, pronotum, mesopleuron, metapleuron; setae on propodeum, basal tergites and posterior sides of coxae very few.

Blackish brown except mouthparts and malar space creamy, sternites creamy, fore and mid coxa and all trochanters and trochantelli largely yellow, antenna dull yellow ventrally, infuscate over entire dorsal side. Hind coxae fuscous in basal 2/3, hind femur brownish, except for basal third. Clypeus apically and sometimes dorsal ridge of upper

face between antennae narrowly yellowish, frontal orbits yellow to vertex. One paratype from Cheongdo-gun has a lighter face and hind legs.

Male. Unknown.

Biology. Hosts unknown.

Etymology. Named from the Greek *λευκο* (white) and *στομα* (mouth) after the creamy mouthparts.

Comparison. Compared with the other species that have antennal sockets on a shelf, the face is granulate, the inner orbits yellowish up to the level of the lateral ocelli, antenna comparatively short and thick, with 22 flagellomeres, malar space and mouthparts creamy, notauli well developed.

Material examined. ***Holotype:*** female; South Korea, **GG**: Pocheon-si, Soheur-eup, Jikdong-ri, 51-7, Korean National Arboretum, Saengtae tower, 37°44'56"N, 127°08'54.5"E, 17–30.V.2013, I.G. Kim leg. (DNUE).

Paratypes: South Korea, 1♀, **GB**: Daegu-si, Dong-gu, Palgongsan-ro, 237 gil (site 39), 35°59'19.55"N, 128°42'55.55"E, MT, 12.VI–14.VII.2014, J.W. Lee leg. (DNUE); **GB:** 1♀, Cheongdo-gun, Unmun-myeon, Mt. Unmun 35°38'32"N, 128°57'50"E, 2–16.VIII.2013, J.W. Lee leg. (DNUE).

Distribution. South Korea (GG, GB).

12. *Orthocentrus marginatus* Holmgren, 1858

Figs 6C, D

Biology. Hosts unknown.

Material examined. South Korea, **GB**: 1♀, Gunwi-gun, Bugye-myeon, Dongsan-ri, San 75 Odoam, 10.VII–1.VII.2015, J.W. Lee leg. (NIBR); **GN:** 1♀, Sancheong-gun, Sicheon-myeon, Seseoksanjang, 35°18'N, 127°41'E, 26.VII–12.X.2001, J.W. Lee leg. (DNUE); **GG**: 1♀, Yongin-si Suji-gu Gwanggyosan 6–24.IX.2008, J.O. Lim leg. (DNUE–0131); **GW**: 1♀, Pyeong-chang-gun Yong-pyeong-myeon Gyebangsan 28.VI–12.VIII.2012, J.Y. Park leg. (DNUE–0121); **JB**: 1♀, Muju-gun, Mupung-myeon, Hyeonnae-ri, San 3, Mt. Bakseoksan, 35°59'2.79"N, 127°52'30.74"E, 17.VI–2.VII.2015 J.W. Lee leg. (ZIN).

Distribution. Palaearctic; *South Korea (GB, GN, GG, GW, JB).

13. *Orthocentrus orientalis* Humala & Lee, sp. nov.

http://zoobank.org/2E90BC35-B098-401B-8C14-7A1BD2EF69A7

Fig. 10

Description. Female. Fore wing length 2.4–2.8 mm.

Face at level of antennal sockets 1.1 times as wide as high; face smooth and densely punctate, eyes not setose, dorsal ridge of face in between antennal sockets without a median prominence; face profile straight, slightly impressed dorsally, edge of clypeus

straight, antennal sockets on a shelf; inner orbits subparallel; subocular sulcus distinct, nearly straight; maxillary palp long, reaching beyond to fore coxa. In dorsal view, head posteriorly concave, temples short, lateral ocellus distant from eye by a distance 1.5 times longer than its maximum diameter, POL 1.6 times as long as diameter of lateral ocellus. Minimum distance between antennal sockets about 0.6 × of the socket diameter; antenna with 22–24 flagellomeres (n = 10) which gradually shorten towards apex; first flagellomere 2.3–2.5 times as long as wide and 0.6 times as long as scape; scape nearly parallel-sided.

Mesosoma smooth and polished except pronotum with short striations posteroventrally, propodeum with alutaceous-coriaceous microsculpture; mesoscutum with notauli anteriorly indicated; in profile, scutellum weakly convex, metapleuron slightly convex; propodeum with posterior transverse carina between lateral longitudinal carinae, lateromedian longitudinal carinae complete, lateral longitudinal carinae weak but present posteriorly, spiracle small.

Legs slightly flattened; coxae and femora polished, tibiae and tarsi coriaceous; hind femur 2.8 times as long as high, hind tibia 4.0 times as long as apically wide; tibiae with spine-like setae, spurs of hind tibia distinctly curved apically.

Wings not particularly narrow, fore wing with areolet closed, slightly transverse, narrowly sessile, vein 3rs-m weak; 2m-cu meeting areolet at apical 0.7, vein Rs gently bent towards wing apex; vein cu-a distad of Rs&M; nervellus angled below the middle.

Metasoma slender and considerably compressed from tergite 3 to apex. First tergite elongate, slightly widening posteriorly, 2.1 times as long as posteriorly wide; coriaceous-strigose, lateromedian longitudinal carinae weak and indistinct, with shallow transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally. Second tergite parallel-sided, 1.8 times as long as posteriorly wide; coriaceous and finely strigose, with shallow transverse impressions originating at about middle of tergite, sloping posteriorly, polished apically; small thyridia oval. Third tergite elongate, nearly 2.0 times as long as posteriorly wide, coriaceous medio-basally, polished in posterior half. Remaining tergites unsculptured. Ovipositor thin, slightly upcurved, without dorsal notch, pointed apically; ovipositor sheath narrow, parallel-sided, with dense setae longer than sheath width and curved backwards.

Body largely setose except eyes, pronotum, mesopleuron and metapleuron; setae scattered on anterior tergites and posterior sides of coxae.

Dark brown except face, clypeus, malar space, antennae, hind legs yellowish brown; mouthparts, tegula, propleuron, hind corners of pronotum, fore and mid legs yellowish; metasoma from tergite 4 brown; sternites creamy; sometimes lower inner orbits with blurred reddish-brown marks.

Male. Unknown.

Biology. Hosts unknown.

Etymology. This species is named from the Latin *orientalis* (eastern) after its geographical distribution, as the Korean Peninsula is situated in the Far East.

Comparison. Compared with the other species that have antennae on a shelf, it has a granulate face and no distinct yellow marks along the inner orbits, the first flagellomere

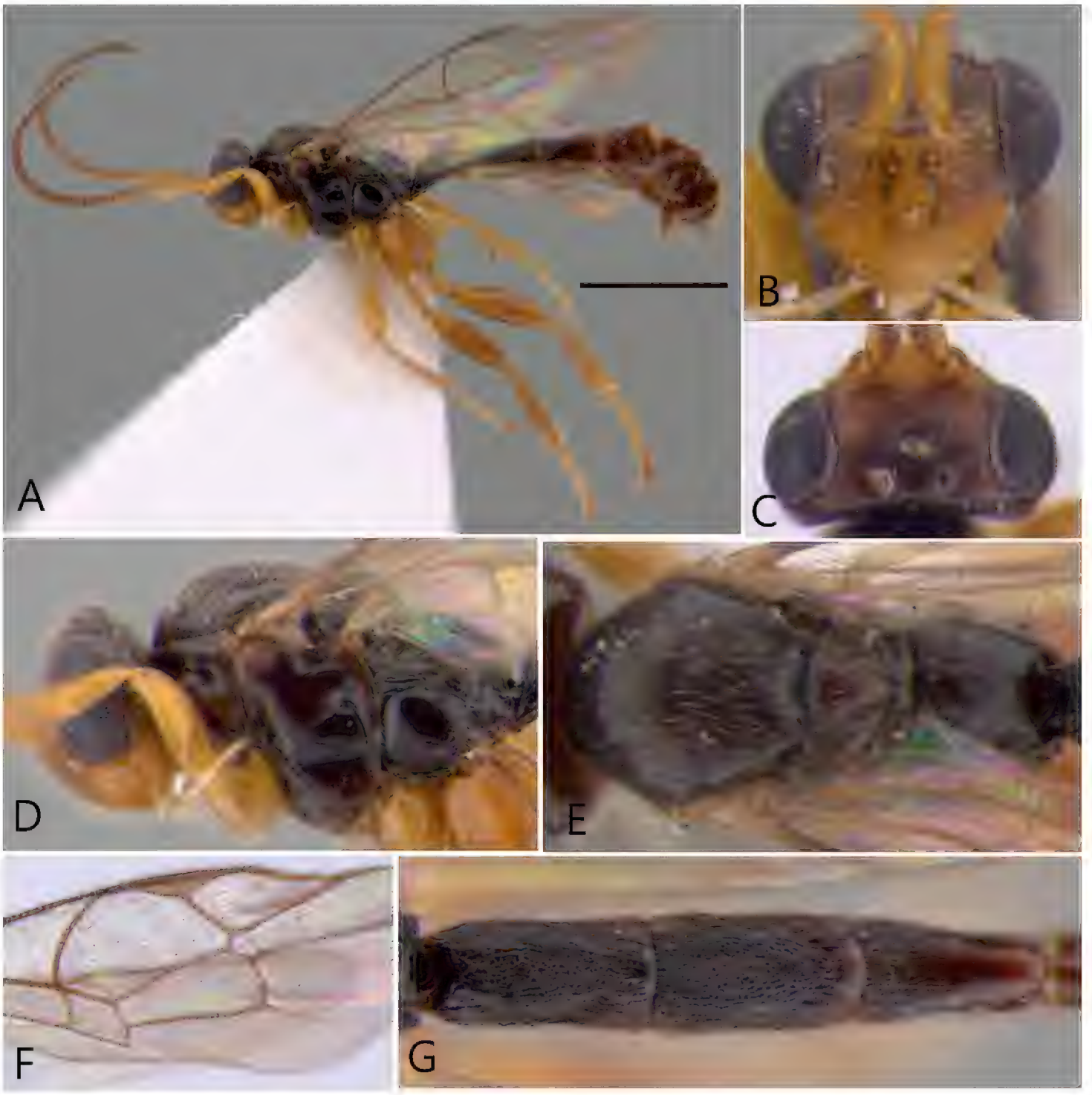

Figure 10. *Orthocentrus orientalis* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** areolet **G** first to third tergites in dorsal view.

2.3–2.5 times as long as wide, the areolet comparatively small, the first tergite 2.1 times as long as posteriorly wide, the second tergite 1.8 times as long as posteriorly wide. Additionally, the subocular sulcus is nearly straight, the POL 1.6 times as long as the diameter of a lateral ocellus, and the fore wing length is 2.4–2.8 mm (unlike in *O. parvus*).

Material examined. ***Holotype:*** female; South Korea **GG**: Mt. Yongmunsan Yeonsu, Yongmun, Yangpyeong, 320 m, MT III, 26.VI–16.VII.2009, J.O. Lim leg. (DNUE–0309).

Paratypes: South Korea, **GB:** 2♀, Mungyeong-si, Gaeun-eup, Wanjang-ri, Mt. Songnisan National Park, Beorimigijae, 36°40'59"N, 127°57'07"E, MT, 17.VII–12.VIII.2013, J.K. Choi leg. (DNUEU–0075, ZIN–0079); **GN**: 1♀, Dapcheon-ri, Ibanseong-myeon, Jinju-si, MT III, 27.VI–4.VII.2005, B.K. Ahn leg. (DNUE–0302); **GG**:

1♀, Mt. Yongmunsan Yeonsu, Yongmun, Yangpyeong, 324 m, MT III, 26.VI–16.VII.2009, J.O. Lim leg. (DNUE–0307); **GW**: 1♀, Chuncheon-si Dong-myeon Jinae-ri, 1–10.VII.2005, S.J. Jang leg., S.N.U. (DNUE–0387); 2♀, Wonju-si, Heungeop-myeon, Yeonse University, MT, 22.VII–11.VIII.2007, J.W. Lee leg. (DNUE–0152, 0035); **JB**: 2♀, Jeongeup-si, Naejang-dong Naejang-san, Geumseongyegok (14 site), MT, 29.VI-6.VII.2008, J.W. Lee leg. (DNUE–0313, 0315); **JN**: 1♀, Kwangju-si, Buk-gu, Geumgok-dong, Mudeungsan Nat. park Wonhyosa, MT, 26.VI–27.VII.2013, J.K. Choi leg. (DNUE–0141);

Distribution. South Korea (GB, GN, GG, GW, JB, JN).

14. *Orthocentrus pacificus* Humala & Lee, sp. nov.

http://zoobank.org/9B35FFE4-6D2E-400A-AB6D-BBFEC3AF82FC

Fig. 11

Description. Female. Body length 2.8–3.0 mm, fore wing length 2.2–2.5 mm.

Face at level of antennal sockets 1.1 times as wide as high; face densely punctate, eyes with short indistinct setae, inner orbits divergent ventrally, vertex somewhat prominent; dorsal ridge of face in between antennal sockets without a median prominence; face profile slightly convex, edge of clypeus convex, antennal sockets on a shelf; subocular sulcus distinct, strongly bent towards occiput; maxillary palp long, reaching beyond to fore coxa. In dorsal view, head posteriorly concave, occipital carina weak, widely interrupted dorsally; temples distinct, lateral ocellus distant from eye by a distance 1.7 times longer than its maximum diameter, POL 1.2 times as long as ocellar diameter of lateral ocellus. Minimum distance between antennal sockets about 0.4× of the diameter of socket; antenna with 24–25 flagellomeres (n=9) which do not gradually shorten towards apex; first flagellomere about 1.1 times as long as wide and about 1/3 of the scape length; scape nearly parallel-sided.

Mesosoma with microsculpture except pronotum with short striations posteroventrally, propodeum with coriaceous microsculpture; mesoscutum with notauli anteriorly indicated; in profile, scutellum weakly convex, metapleuron slightly convex; propodeum with posterior transverse carina and lateral longitudinal carinae complete, lateromedian longitudinal carinae weak, spiracle small.

Legs slightly flattened; coxae and femora polished, tibiae and tarsi coriaceous; hind femur 2.8 times as long as high, hind tibia 3.5 times as long as apically wide; tibiae with spine-like setae.

Wings not particularly narrow, fore wing with areolet closed, clearly transverse, narrowly sessile, 2m-cu meeting areolet at apical 0.7, vein Rs gently bent towards wing apex; vein cu-a distad of Rs&M; nervellus angled below the middle.

First tergite of metasoma elongate, slightly widening posteriorly, 1.6 times as long as posteriorly wide; coriaceous, lateromedian longitudinal carinae weak and indistinct, with shallow transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally. Second tergite nearly parallel-sided, 1.2 times as long

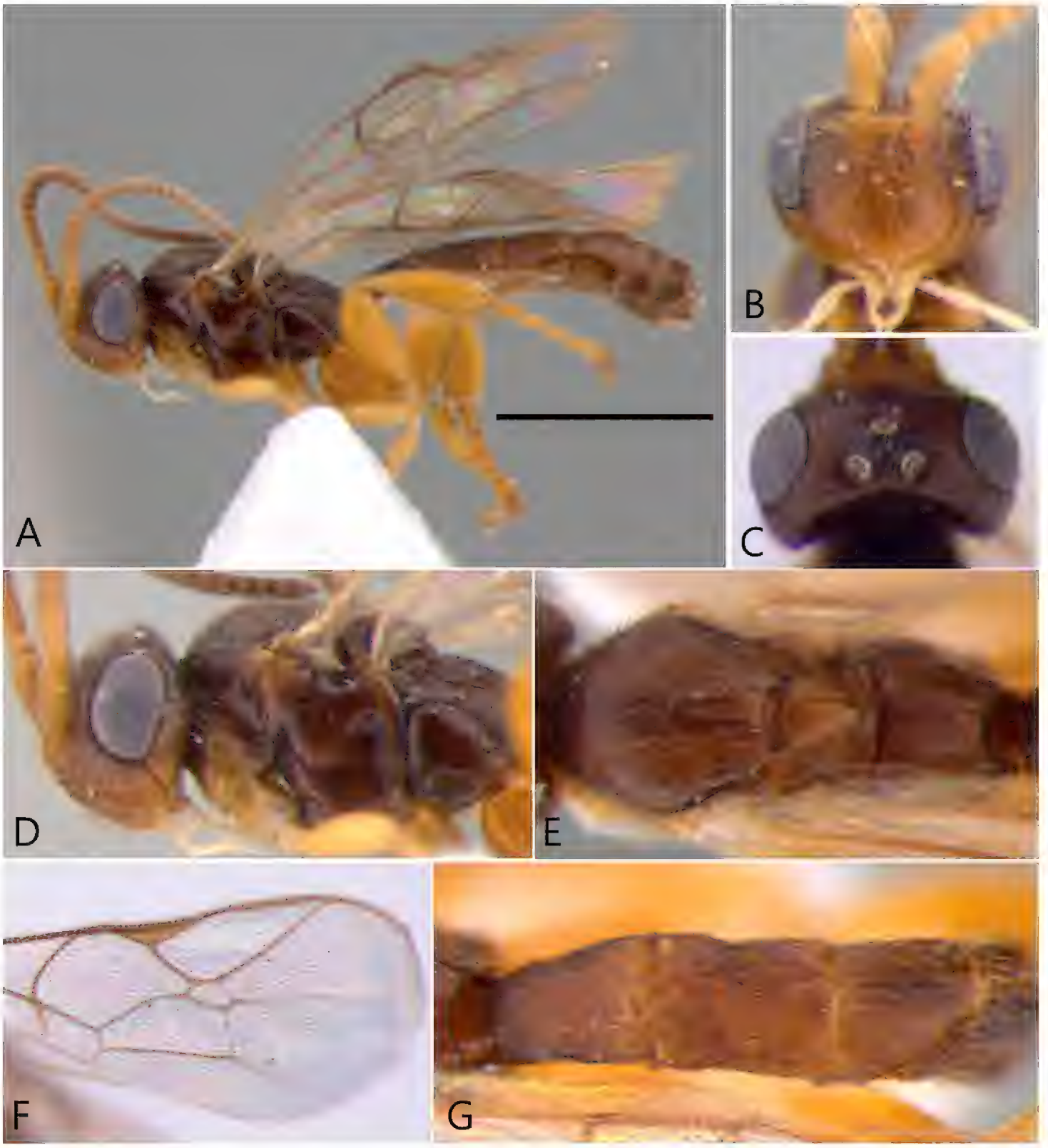

Figure 11. *Orthocentrus pacificus* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** areolet **G** first to third tergites in dorsal view.

as posteriorly wide; coriaceous, with transverse furrows originating at about middle of tergite, sloping posteriorly, meeting centrally; anterior thyridia small, oval, contrastingly coloured; second thyridia vaguely defined, medial, same colour as surrounding cuticle. Third tergite nearly as long as posteriorly wide, coriaceous medio-anteriorly, polished in apical part, with second thyridia round. Remaining tergites unsculptured. Ovipositor not visible; sheaths narrow, with dense setae curved backwards.

Body largely setose except pronotum, mesopleuron and metapleuron; setae scattered on anterior tergites and posterior sides of coxae.

Brown to light-brown except face, clypeus, malar space, lower temple, antenna yellow; mouthparts, tegula, propleuron creamy; all legs yellow; metasoma from tergite 4 light-brown; sternites creamy; sometimes pronotum, propleuron, mesopleuron, scutellum, hind margins of tergites 2–3 orange.

Male. Unknown.

Biology. Hosts unknown.

Etymology. This species name refers to its geographical distribution – relating to the Pacific Ocean and the region where Korea is situated.

Comparison. Similar to *O. fulvipes* Grav. in having an occipital carina, subocular sulcus strongly bent towards the occiput, all legs entirely red, but differs in its smaller size (fore wing 2.2–2.5 mm), the anterior tergites coriaceous without longitudinal striae; the first tergite 1.6 times as long as posteriorly wide, the second tergite 1.2 times as long as posteriorly wide.

Material examined. ***Holotype:*** female; South Korea, **GG:** Namyangju-si, Choanmyeon, Songcho-ri, Mt. Ungilsan, MT (II), Alt. 134 m, 37°34'43.3"N, 127°18'37.5"E, 27.V–10.VI.2009, J.O. Lim leg. (DNUE–0165).

Paratypes: South Korea, **CN:** 1♀, Daejeon-si, Dong-gu, Daejeon University, MT, 8.X–30XI.2007, J.W. Lee leg. (ZIN–0129); 1♀, Daejeon-si, Dong-gu, Daehang-no 62, Daejeon University, MT, 15.VIII–30.IX.2006, J.W. Lee leg. (DNUE–0261); **GB:** 1♀, Gyeongsan-si, Dae-dong, Yeungnam University, MT, 21.IV–19.V.2004, J.W. Lee leg. (DNUE–0126); 1♀, Chilgok-gun, Dongmyeong-myeon, Hakmyeong-ri, San 25, site 23, MT, 36°01'53.45"N, 128°33'46.93"E, 30.VIII–22.IX.2014, J.W. Lee leg. (DNUE); **GN:** 1♀, Hapcheon-gun, Gaya-myeon, Hwangsan-ri, San 124-3, 10.VII–14.VIII.2014, J.W. Lee (DNUE); **GG:** 1♀, Mt. Ungilsan, Songchon, Choan, Namyangiu, 134 m, 37°34'43.3"N, 127°18'37.5"E, MT II, 27.V–10.VI.2009, Jongok Lim leg. (ZIN–0171); 2♀, Anyang-si, Manan-gu, Mt. Gwanaksan, 5–19.VII.2007, J.O. Lim leg. (DNUE–0304, 0305); **GW:** 1♀, Donghae-si, Samhwa-dong, Mureung valley, MT, 1–28.VII.2007, J.W. Lee leg. (DNUE–0298);

Distribution. South Korea (CN, GB, GG, GN).

15. *Orthocentrus parvus* Humala & Lee, sp. nov.

http://zoobank.org/233D2588-17AC-4C8B-A8EB-7CFBE0613CB0

Fig. 12

Description. Fore wing length 1.7 mm.

Face at level of antennal sockets 1.2 times as wide as high; face punctate, eyes not setose, dorsal ridge of face inbetween antennal sockets without a median prominence; face in profile almost evenly round, slightly more so dorsally, edge of clypeus slightly impressed, antennal sockets on a shelf but shelf not particularly high; subocular sulcus distinct, bent towards occiput; maxillary palp reaching to fore coxa. In dorsal view, head posteriorly slightly concave, temples narrow, lateral ocellus separated from eye by a distance 1.2 times longer than its maximum diameter, POL 1.1 times as long as diameter of lateral ocel-

Figure 12. *Orthocentrus parvus* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head and mesosoma in dorsal view **D** head in dorsal view **E** head and mesosoma in lateral view **F** fore wing.

lus, lacking ocellar-ocular groove. Occipital carina reduced. Minimum distance between antennal sockets slightly more than half diameter of socket; antenna with 23 short flagellomeres which do not gradually shorten towards apex; basal flagellomere subquadrate and about 1/3 of length of scape; scape almost parallel-sided, internal surface slightly convex.

Mesosoma smooth and polished except dorsal propodeum with pustulate microsculpture; mesoscutum with anteriorly indicated notauli; scutellum destroyed by pin, metapleuron slightly convex; propodeum with posterior transverse carina strong, present between lateral longitudinal carinae, lateromedian longitudinal carinae complete, spiracle small.

Legs broad, coxae and femora polished, tibiae and tarsi coriaceous-granulate; hind femur 2.9 times as long as high, hind tibia 4.0 times as long as apically wide; tibiae with spine-like setae.

Wings not particularly narrow; fore wing with areolet closed but 3rs-m weak, areolet nearly as wide as high, 2m-cu meeting areolet at apical 0.7, vein Rs straight; nervellus not intercepted, straight.

First tergite stout, posteriorly slightly widening, 1.4 times as long as posteriorly wide; coriaceous, without lateromedian longitudinal carinae, with transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally. Second tergite 1.2 times as long as posteriorly wide; coriaceous, with faint transverse impressions originating at about middle of tergite, slightly sloping posteriorly, not meeting centrally; thyridia contrastingly coloured. Remaining tergites smooth and polished. Ovipositor straight; ovipositor sheath with dense and long, curved backwards-directed setae.

Body largely setose except pronotum, mesopleuron and metapleuron; setae scattered on propodeum and posterior sides of coxae

Brown except mouthparts, fore and mid coxae, trochanters and trochantelli, creamy to light yellow, sternites creamy, legs, antennae yellow.

Male. Unknown.

Biology. Hosts unknown.

Etymology. Named from the Latin *parvus* (small, inconspicuous) after its small size.

Comparison. Compared with the other species that have antennae on a distinct shelf and face finely punctate, the size is smaller (fore wing 1.7 mm), eyes without short setae, the POL shorter, the temples narrower, occipital carina not developed, unlike in *O. pacificus*. Additionally, compared with other small species, *O. parvus* has narrow temples, the subocular sulcus is bent and the first flagellomere subquadrate (unlike in *O. orientalis*).

Material examined. ***Holotype:*** female; South Korea, **GG**: Mt. Gwanggyo, Suji-gu, Yongin-si, 214 m, 37°19'56.8"N, 127°02'37.8"E, 15–25.VII.2008, J.W. Lee leg. (DNUE–0562).

Distribution. South Korea (GG).

16. *Orthocentrus patulus* Holmgren, 1858

Figs 6E, F

Biology. Hosts unknown.

Material examined. South Korea, **CB**: 1♀, Danyang-gun, Danyang-eup, Cheongdong-ri, Chonndong valley, 19–30.IV.2007, J.W. Lee leg. (DNUE– 0038).

Distribution. Palaearctic; *South Korea (CB).

17. *Orthocentrus protervus* Holmgren, 1858

Figs 14A, B

Biology. Parasitoid of *Sciophila hirta* Meigen (Diptera, Mycetophilidae).

Material examined. South Korea, **GG**: 1♀, Pocheon-si, Soheur-eup, Jikdong-ri, 51-7, Korean National Arboretum, Saengtae tower, 37°44'56"N, 127°08'54.5"E, 20–29.VIII.2013, I.G. Kim leg. (DNUE); **GW**: 1♀, Mt. Taebaeksan, Yuilsa, MT, 20.VI–11.VII.1999, D.S. Ku leg. (NIAS).

Distribution. Palaearctic; *South Korea (GG, GW).

18. *Orthocentrus pulchellus* Humala & Lee, sp. nov.

http://zoobank.org/1AF75673-BF1E-450E-9E7E-A5D7602A0318

Fig. 13

Description. Female. Fore wing length 3.1 mm.

Face at level of antennal sockets 1.4 times as wide as high; face smooth, polished, sparsely punctate, eyes not setose, dorsal ridge of face in between antennal sockets with a median blunt low prominence; face profile straight except dorsally very slightly impressed, inner orbits slightly divergent ventrally; edge of clypeus straight, antennal sockets not on a distinct high shelf; subocular sulcus narrow, nearly straight; maxillary palp reaching beyond fore coxa. In dorsal view, head posteriorly concave, temples very short, lateral ocellus separated from eye by a distance of 1.8 times longer than its maximum diameter, POL 1.5 times as long as diameter of lateral ocellus; ocellar-ocular grooves present. Minimum distance between antennal sockets about half of the diameter of socket; antenna moderately long, with 30–31 flagellomeres elongate (n = 4); flagellum considerably thinned apically; first flagellomere about 3.5 times as long as wide and about 0.8 times as long as scape; scape slightly convex on inner surface, slightly concave on outer surface.

Mesosoma smooth and polished; mesoscutum anteriorly with distinct notauli; in profile, scutellum high, metapleuron slightly convex; propodeum with posterior transverse carina complete, strong and raised between lateral longitudinal carinae, lateromedian longitudinal carinae complete, lateral longitudinal carinae distinct, spiracle small.

Legs robust; coxae polished, femora with coriaceous microsculpture, tibiae and tarsi coriaceous-granulate; hind femur 2.9 times as long as high, hind tibia 3.7 times as long as apically wide; tibiae with spine-like setae.

Wings not particularly narrow; fore wing without areolet, vein 2rs-m about 0.6 times as long as portion of 1m-cu between 2rs-m and 2m-cu; pterostigma comparatively wide, vein Rs bent upwards, fore wing with vein Rs+2r meeting apical 0.6 of pterostigma; vein cu-a strongly oblique, distad of Rs&M; nervellus intercepted below.

First tergite 1.8 times as long as posteriorly wide; coriaceous, with two lateromedian longitudinal carinae and longitudinal striae, with transverse impressions originating at about middle of tergite, sloping posteriorly, meeting centrally.

Second tergite 1.6 times as long as posteriorly wide; coriaceous and longitudinally striate, with developed lateromedian longitudinal carinae, anterior corners impressed and transverse groove near posterior margin bending anteriorly near lateral margins, forming a somewhat uplifted area medially; oval thyridia contrastingly coloured.

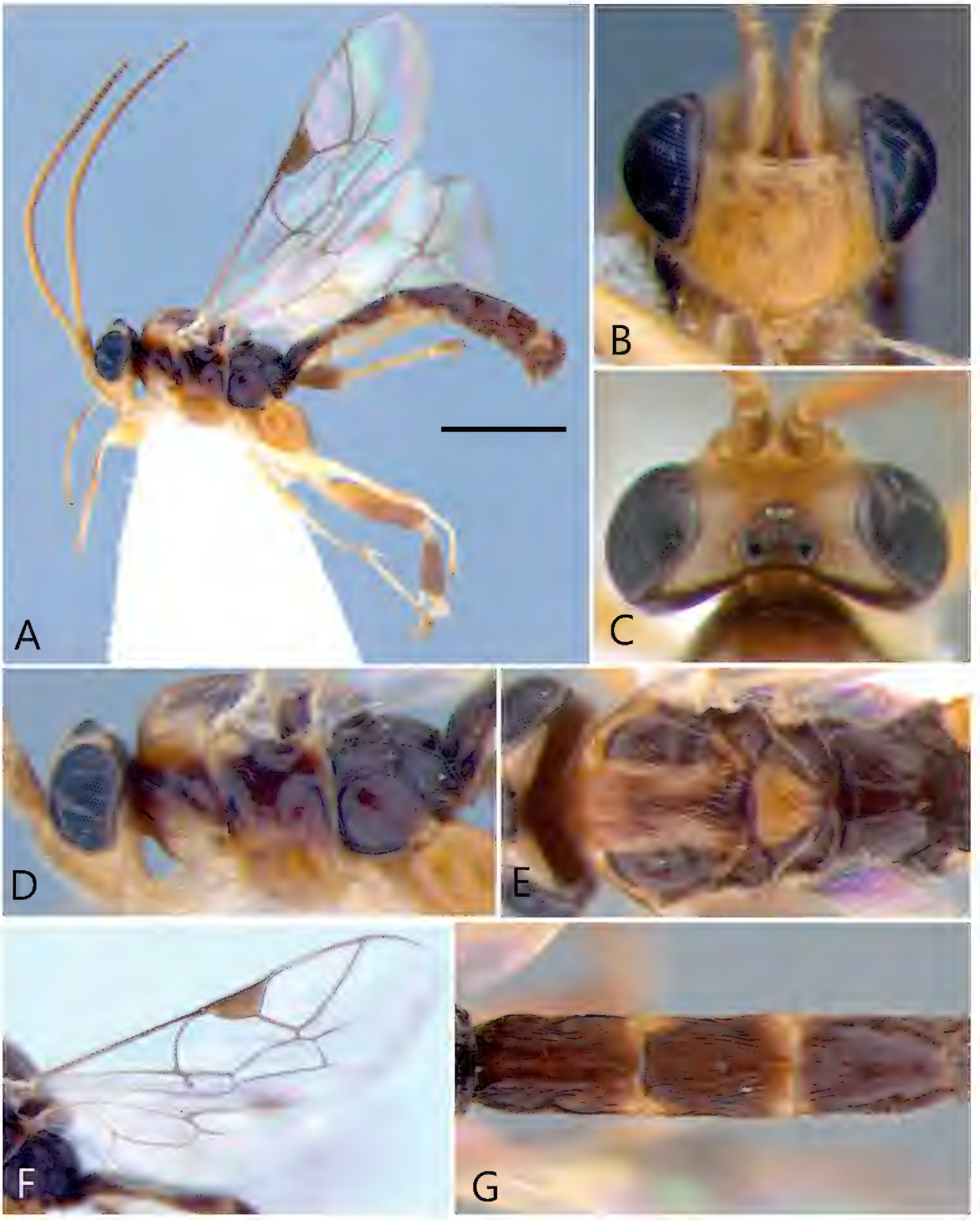

Figure 13. *Orthocentrus pulchellus* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** wings **G** first to third tergites in dorsal view.

Third tergite longitudinally striate anteriorly, remainder of metasoma unsculptured, polished. Ovipositor thin, comparatively short, weakly upcurved, without subapical dorsal notch; sheaths short, concealed by hypopygium.

Body setose except eyes, pronotum, mesopleuron and metapleuron, setae scattered on metasoma and posterior sides of coxae.

Brown; face, frons and vertex yellowish, inner orbits broadly creamy-yellow up to occiput, interocellar area fuscous; antenna yellowish-brown; malar area yellow posterior to subocular sulcus and up to level of half of eye; mouthparts, fore and mid legs, hind coxa, trochanters and tarsi and longitudinal bars along notauli yellow; propleuron, lower and upper pronotum, medial part of mesoscutum anteriorly, scutellum, mesopleuron in lower half, hind coxa and trochanters and tarsi reddish brown; posterior margin of tergite 1and anterior corners and posterior margin of tergite 2 yellowish-brown; sometimes hind femur except basal 0.2 and hind tibia except light basal ring brown.

Male. Unknown.

Biology. Hosts unknown.

Etymology. Named from the Latin *pulchellus* (nice, pretty) after its rich body colouration.

Comparison. This is a distinctive species on account of the entirely yellow face and frons (except for the interocellar area), the absence of the fore wing areolet and the presence of yellow bars along the notauli on the median part of the mesoscutum.

Material examined. ***Holotype:*** female; South Korea, **GB**: Namsa-ri, Hyeongok-myeon, Kyeongju-si, MT II, 15–29.IX.2005, J.T. Mun leg. (DNUE).

Paratypes: South Korea, **CN**: 1♀, Daejeon, Donggu, Daehang-no 65, Daejeon University, MT, 15.VIII–30.IX.2006, J.W. Lee leg. (DNUE–0260); **GG**: 2♀, Seoul, Cheongyangri-dong, Dongdaemun-gu, MT III, S.N.U. 12–20.IX.2005, W.I. Choi leg. (DNUE–0908,0910).

Distribution. South Korea (CN, GB, GG).

19. *Orthocentrus sannio* Holmgren, 1858

Figs 14C, D

Biology. Hosts unknown.

Material examined. South Korea, **GW**: 1♀, Mt. Sundalsan, Yongmok, 28.V.1998 (NIAS); 1♂, Mt. Jirisan National Park, Bamsagol, 23.VII.1989, J.G. Kim leg. (DNUE–0475); **GB**: 1♂, Namsa-ri, Hyeongok-myeon, Kyeongju-si, MT II, 15–29. IX.2005, J.T. Mun leg. (DNUE); 1♂, Yeongcheong-si, Cheongtong-myeon Temp., Eunhaesa, 36°02'11.74"N, 128°34'18.17"E, MT, 21.VII–10.VIII.2015, J.W. Lee leg. (DNUE); **GW**: 2♀, Inje-gun Girin-myeon Jindong-ri Jeombongsan, 37°34'43.2"N, 127°18'40.1"E, 26.VI–28.VII.2012, J.Y. Park leg. (DNUE–0534, 0535).

Distribution. Palaearctic; *South Korea (GB, GW).

20. *Orthocentrus setosus* Humala & Lee, sp. nov.

http://zoobank.org/57490ee5-a30d-4e84-830b-8cf3e52412bd

Fig. 15

Description. Fore wing length 2.0–2.1 mm.

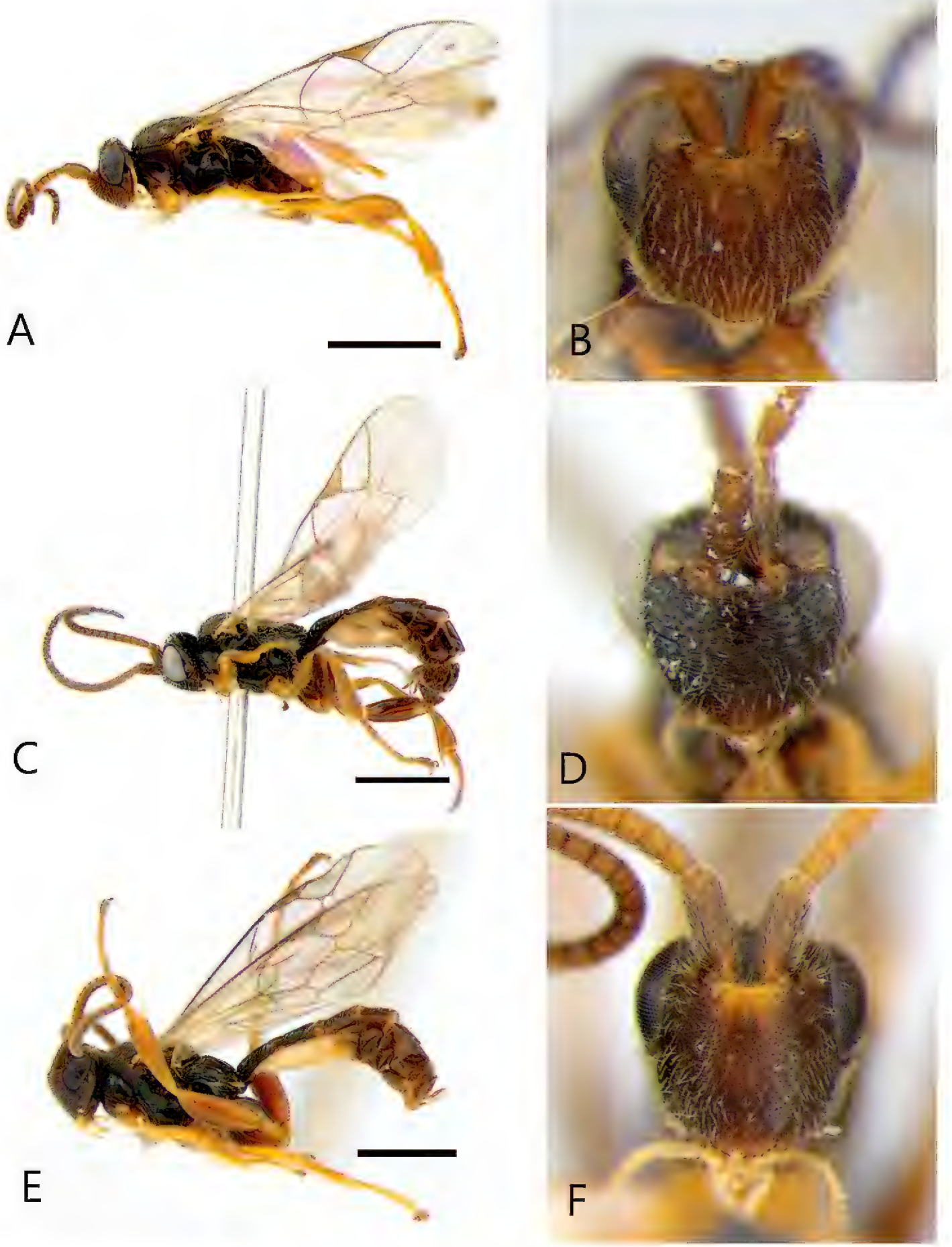

Figure 14. *Orthocentrus* spp. **A** Habitus in lateral view of *O. protervus* **B** head in frontal view of *O. protervus* **C** habitus in lateral view of *O. sannio* **D** head in frontal view of *O. sannio* **E** habitus in lateral view of *O. spurius* **F** head in frontal view of *O. spurius*.

Face at level of antennal sockets 1.2 times as wide as high; face coarsely papillate, eyes densely setose, dorsal ridge of face in between antennal sockets without a median prominence; face in profile almost evenly round, edge of clypeus very slightly im-

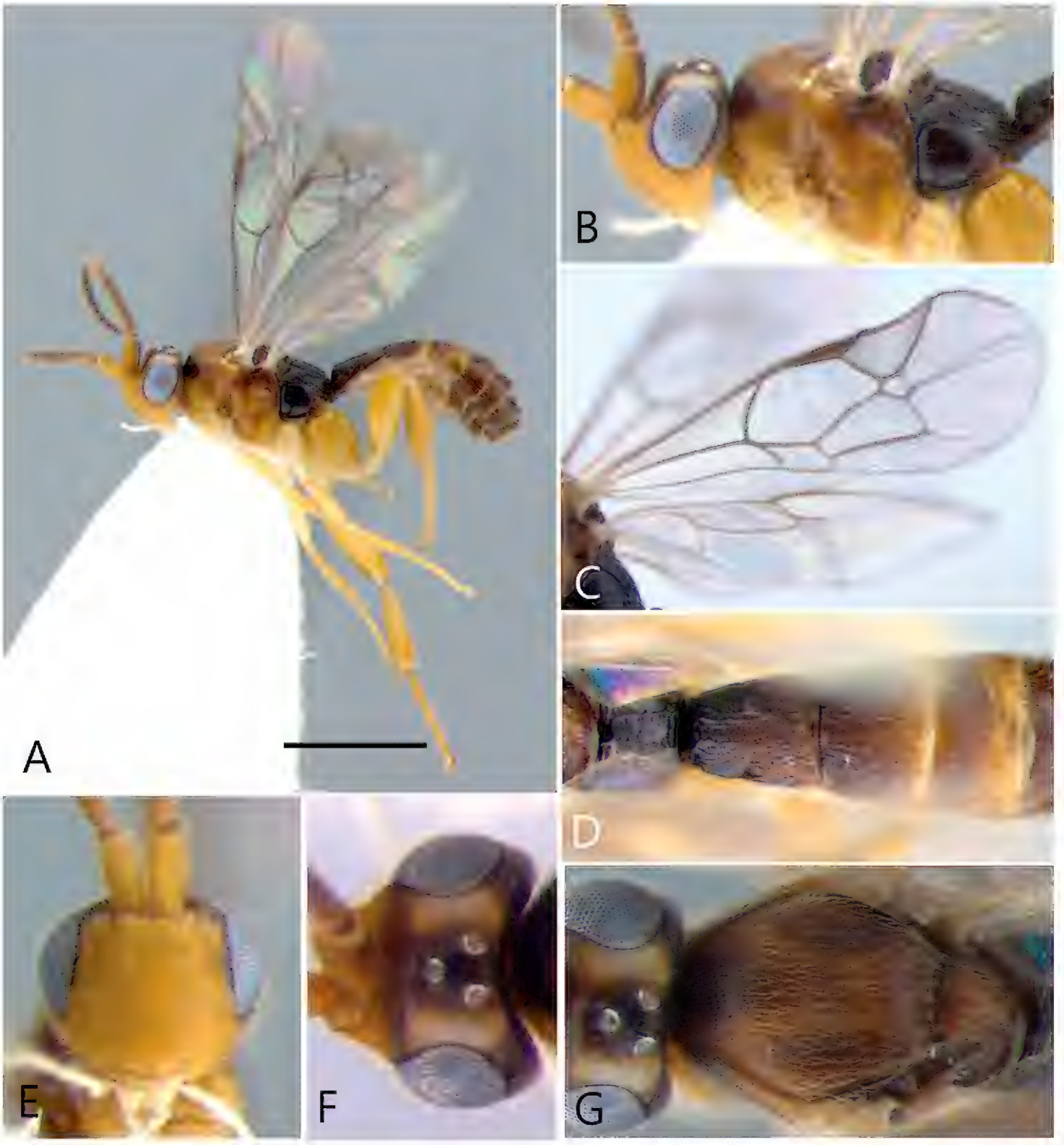

Figure 15. *Orthocentrus setosus* sp. nov. Holotype. **A** Habitus in lateral view **B** head and mesosoma in lateral view **C** wings **D** propodeum and first to third tergites in dorsal view **E** head in frontal view **F** head in dorsal view **G** mesoscutum in dorsal view.

pressed, antennal sockets on a shelf; subocular sulcus weak and shallow, slightly bent towards occiput; maxillary palp reaching to beyond fore coxa. In dorsal view, head posteriorly slightly concave, temples narrow, lateral ocellus separated from eye by a distance of 2 times longer than its maximum diameter, POL 1.1 times as long as diameter of lateral ocellus, lacking ocellar-ocular grooves. Minimum distance between antennal sockets slightly less than half diameter of socket; antenna comparatively short, with 26 short flagellomeres which do not gradually shorten towards apex; first flagellomere 0.8 times as long as wide and about as long as 1/3 of scape; scape almost parallel-sided.

Mesosoma smooth and polished except dorsal propodeum coriaceous with punctures; mesoscutum lacking notauli; in profile, scutellum weakly convex, metapleuron slightly convex; propodeum with posterior transverse carina strong, present between lateral longitudinal carinae, lateromedian longitudinal carinae complete, and lateral longitudinal carinae present as short stubs not reaching spiracles, spiracle small.

Legs broad, hind coxa large; coxae and femora polished, tibiae and tarsi coriaceous-granulate; hind femur 2.6 times as long as high, hind tibia 3.3 times as long as apically wide; tibiae with spine-like setae.

Wings not particularly narrow; fore wing with areolet closed but 3rs-m weak, areolet slightly wider than high, 2m-cu meeting areolet at apical 0.6, vein Rs straight, pterostigma narrow, vein Rs+2r meeting pterostigma at apical 0.6; vein cu-a well distad of Rs&M; nervellus slightly intercepted in lower third, almost straight.

First tergite stout, apically widening, 1.5 times as long as posteriorly wide; coriaceous, without lateromedian longitudinal carinae, with transverse impressions originating at about middle of tergite, sloping posteriorly, not meeting centrally. Second tergite 0.7 times as long as posteriorly wide; coriaceous to rugose, with transverse impressions originating at about middle of tergite, slightly sloping posteriorly, meeting centrally; small transverse thyridia contrastingly coloured. Third tergite coriaceous with transverse furrow, posteriorly polished; remaining tergites smooth and polished. Ovipositor short, straight, without dorsal notch; ovipositor sheath invisible.

Body largely setose except pronotum, mesopleuron and metapleuron; setae scattered on propodeum and posterior sides of coxae.

Brown, except mouthparts, orbital marks between eyes and ocelli, fore and mid coxae, trochanters and trochantelli, creamy to light yellow, sternites creamy to brownish creamy, face, clypeus, malar space, scape, propleuron, pronotum, anterior part and lateral patches on mesoscutum, scutellum, mesopleuron, legs, posterior margins of second and third tergites yellow to dull orange.

Male. Unknown.

Biology. Hosts unknown.

Etymology. Named from the Latin *setosus* (setose) after the largely setose body, including eyes.

Comparison. Compared with the other species that have densely setose eyes, the antennae are comparatively short, with 26 flagellomeres, unlike in *O. hirsutor* and *O. trichophthalmus.* From the allied *O. trichoptilus* it differs in the yellowish face, mesoscutum, propleuron and mesopleuron, the creamy vertex marks and the subocular sulcus hardly visible.

Material examined. ***Holotype:*** female; South Korea, **JB**: Muju-gun, Mupung-myeon, Hyeonnae-ri, San 3, Mt. Bakseoksan, 35°59'2.79"N, 127°52'30.74"E, 5–18. VIII.2015, J.W. Lee leg. (DNUE).

Paratype: South Korea, **GB**: 1♀, Gyeongsan-si Dae-dong, Yeungnam University, 4–23.IX.2008, J.W. Lee leg. (DNUE– 0140).

Distribution. South Korea (GB, JB).

21. *Orthocentrus spurius* Gravenhorst, 1829
Figs 14E, F

= *protuberans* Holmgren 1858

Biology. Hosts unknown.

Material examined. South Korea, **GW:** 1♀, Mt. Taebaeksan, MT, 14.V–20.VI.1999, D.S. Ku leg. (NIAS).

Distribution. Holarctic; *South Korea (GW).

22. *Orthocentrus stigmaticus* Holmgren, 1858 (stat. rev.)
Figs 19A, B

Biology. Hosts unknown.

Material examined. South Korea, **CN**: 1♀, Daejeon, Donggu, Daejeon University, MT, 12.IV–12.V.2007, J.W. Lee leg. (DNUE–0117); 1♂, Seosan-si Haemi-myeon Hanseo University, MT, 4–29.VI.2006, J.W. Lee leg. (DNUE–0369); 1♀, Buyeo-gun Gyuam-myeon Sumok-ri. 35°15'N, 126°50'E, MT, 13.VII–16.VIII.2005, J.W. Lee leg. (DNUE–0265); 1♂, Buyeo-gun Gyuam-myeon Sumokri, MT, 16–2.VI.2005, J.W. Lee leg. (DNUE–0263); **GB**: 1♀, Namsa-ri, Hyeongok-myeon, Kyeongju-si, MT II, 11–18.VIII.2005, J.T. Mun leg. (DNUE–0308); 1♂, Gyeongsan-si, Dae-dong, Yeungnam University, 18.V.1989, J.K. Kim leg. (DNUE–0457); 1♂, Gyeongsan-si Daehak-ro280 Yeungnam University, 35°49'30"N, 128°45'39"E, 13.VI.2013, J.W. Lee leg., (DNUE–0437); 1♀, Mungyeong-si, Mungyeong-eup, Sangcho-ri, Mungyeongsaejae, 10.VI.1992 (DNUE); 1♂, Namsa-ri, Hyeongok-myeon, Kyeongju-si, MT II, 15–29.IX.2005, J.T. Mun leg. (DNUE); 1♀, Namsa-ri, Hyeongok-myeon, Kyeongju-si, MT I, 18–25.VIII.2005, J.T. Mun leg. (NIBR–0276); **GG**: 1♀, Mt. Yongmunsan Yeonsu, Yongmun, Yangpyeong, 324 m, MT III, 26.VI–16.VII.2009, J.O. Lim leg. (DNUE–0301); **GG:** 1♂, [Arb.] Kwanga, Manan-gu, Anyang-si, 37°2'21.6"N, 126°56'56.8"E, 133 m, MT III. 26.VII–8.VIII.2008, S.N.U. Jongok Lim leg. (DNUE–0235); 1♂, Pocheon-si, Soheur-eup, Jikdong-ri, 51–7, Korean National Arboretum, Saengtae tower, 37°45'9.1"N, 127°09'4.7"E, 28.VI–24.VII.2013, I.G. Kim leg. (DNUE); **GN**: 1♂, Dapcheon-ri Ibanseong-myeon Jinju-si, MT III, 27.VI–4.VII.2005 S.N.U. B.K. Ahn leg. (DNUE–0300); **GW:** 1♀, Donghae-si, Samhwa-dong, Mureung valley, 8–16.X.2005, J.W. Lee leg. (DNUE–0555); 1♂, Chuncheon-si Dong-myeon Jinae-ri, 1–8.VIII.2005, S.J. Jang leg., S.N.U. (DNUE–0123); 1♀3♂, Chuncheon-si, Sanong-dong, Gwangwon Provincial Arboretum, 30.VIII–17.IX.2013, I.G. Kim leg. (DNUE); 1♀, same data as for preceding, 30.IV–15.V.2013, I.G. Kim leg. (DNUE); 1♂, Taebaek-si, Hyeol-dong, Yuilsa, 37°06'41.79"N, 128°55'26.46"E, 30.VI.1991, J.W. Lee leg. (DNUE); 1♀, Hongcheon-gun, Bukbang-myeon, Gwangwon Prov., Environment Research Park, 37°45'15.6"N, 127°51'1.7"E, 3–15.X.2013, S.J. Jang leg.

(DNUE); **JB:** 1♀, Wanju-gun, Dongsang-myeon, Daea-ri, San 1, Daea Arboretum, 35°58'24.24"N, 127°18'13.53"E, 1–15.IX.2013, J.M. Park leg. (DNUE); 2♀, same data as for preceding, 16–31.VII.2013 (DNUE); 1♀, Muju-gun, Mupung-myeon, Hyeonnae-ri, San, Mt. Bakseoksan, MT, 37°59'2.79"N, 127°52'30.74"E, 5–16. VI.2015, J.W. Lee leg. (DNUE).

Distribution. Palaearctic; *South Korea (CN, GB, GG, GN, GW, JB).

Remarks. The name *O. stigmaticus* is removed from synonymy with *O. winnertzii* and its status of valid species is resurrected, as both these species occur in the same areas and have distinct morphological differences, what do not meet the criteria for the subspecies definition.

23. *Orthocentrus tenuiventris* Humala & Lee, sp. nov.

http://zoobank.org/B8524C51-FB9F-47EC-8143-2293E5F5688D

Fig. 16

Description. Female. Fore wing length 3.0–3.5 mm.

Face at level of antennal sockets 1.1 times as wide as high; face smooth and densely punctate, eyes not setose, dorsal ridge of face in between antennal sockets without a median prominence; face profile straight, slightly impressed dorsally, edge of clypeus straight, antennal sockets on a shelf; subocular sulcus distinct, bent towards occiput; maxillary palp long, reaching beyond to fore coxa. In dorsal view, head posteriorly slightly concave, temples distinct, lateral ocellus distant from eye by its maximum diameter, POL as long as diameter of lateral ocellus. Minimum distance between antennal sockets about 0.6× of the diameter of socket; antenna with 31–36 flagellomeres (n=10) which gradually shortening towards apex; first flagellomere 2.3–2.5 times as long as wide and about 1/2 of the scape length; scape nearly parallel-sided.

Mesosoma smooth and polished except pronotum with short striations postero-ventrally, propodeum coriaceous with punctures; mesoscutum with distinct notauli; in profile, scutellum somewhat high, metapleuron not convex; propodeum without posterior transverse carina between lateral longitudinal carinae, lateromedian longitudinal carinae weak but complete, lateral longitudinal carinae weak, present posteriorly, spiracle small.

Legs slightly flattened; coxae and femora polished, tibiae and tarsi coriaceous; hind femur 3.4 times as long as high, hind tibia 3.8 times as long as apically wide; tibiae with spine-like setae, spurs of hind tibia distinctly curved apically.

Wings somewhat narrow, cells thus comparatively long and narrow; fore wing with areolet closed, large, conspicuously transverse, 2m-cu meeting areolet at apical 0.7, vein Rs gently bent towards wing apex; vein cu-a clearly distad of Rs&M; nervellus angled in the middle.

First tergite elongate, slightly widening posteriorly, 2.5–3.1 times as long as posteriorly wide; coriaceous-strigose, with weak lateromedian longitudinal carinae, with shallow transverse impressions originating at about middle of tergite, sloping poste-

Figure 16. *Orthocentrus tenuiventris* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** fore wing **G** first to third tergites in dorsal view.

riorly, not meeting centrally. Second tergite parallel-sided, 2.0–2.9 times as long as posteriorly wide; coriaceous, longitudinally striate, with shallow transverse impressions originating at about middle of tergite, sloping posteriorly, polished apically; small thyridia oval. Third tergite elongate, 2.0–2.9 times as long as posteriorly wide, coriaceous, longitudinally striate, polished posteriorly. Remaining tergites unsculptured. Ovipositor thick basally, strongly narrowed and pointed apically, straight, without notch; ovipositor sheath parallel-sided, with dense setae longer than sheath width and strongly curved, backwards pointing.

Body largely setose except eyes, pronotum, mesopleuron and metapleuron; setae conspicuous on tergites and sternites from metasomal segment 3, and very scattered on anterior tergites and posterior sides of coxae.

Dark brown except propleuron, hind corners of pronotum, lower mesopleuron yellowish; antenna, legs, clypeus dull yellow; mouthparts, tegula, and sternites creamy.

Male. Similar to female but laterally paler, creamy white, and antenna pale yellow, creamy white basally; antenna with 29 flagellomeres (n = 2). Otherwise as in female.

Biology. Hosts unknown.

Etymology. Named from the Latin *tenuis* (thin, slender) and *venter* (abdomen) after its long and narrow metasoma.

Comparison. This is a distinctive species on account of the unusually long and slender metasoma (Fig. 16A), the anterior tergites of which are strongly elongate and longitudinally striate (Fig. 16G); the wings are narrow, antenna with 31–36 flagellomeres, basal flagellomere 2.3–2.5 times as long as wide.

Material examined. ***Holotype:*** female; South Korea, **JN**: Gwangyang-si, Okryong-myeon, Chusan-ri, Mt. Baekun, MT (DNUE).

Paratypes: South Korea, **GB**: 1♀, Mungyeong-si Mungyeong-eup Sangcho-ri 288–1 Mungyeongsaejae 10.VI.1992 (DNUE–0248); 1♀, Uljin-gun, Mt. Baekamsan, 20.VI–12.VII.1999, D.S. Ku leg. (NIAS); **GG**: 2♀, Annyang-si, Manan-gu, Gwanaksan, 37°25'06"N, 126°50'56"E, 26.VI–4.VII.2007, J.W. Lim leg. (DNUE–0233,0234); 3♀, Gapyeong-si, Cheongpyeong-myeon Soseong-ri, Mt. Homyeong, 37°43'15"N, 127°29'18.9"E, 11–25.VII.2009, J.O. Lim leg. (DNUE–0906, ZIN–0904,0905); 1♀, Pocheon-si, Soheul-eup, Jikdong-ri, 51-7, Korean National Arboretum, 37°45'9.1"N, 127°08'34.4"E, MT 4, 14–28.VI.2013, I.G. Kim leg. (ZIN); **GW:** 1♀, Donghae-si, Samhwa-dong, Mureung valley, MT, 16–28.VI.2005, J.W. Lee leg. (ZIN–0118); 2♂, Mt. Taebaeksan, Yuilsa, MT, 20.VI–11.VII.1999, D.S. Ku leg. (NIAS); **JB**: 1♀, Jeongeup-si, Samgan-dong, Dapgok-ri, MT, 18.VI.2006, J.W. Lee leg. (DNUE–0401).

Distribution. South Korea (GB, GG, GW, JB, JN).

24. *Orthocentrus trichophthalmus* Humala & Lee, sp. nov.

http://zoobank.org/F1AAAEC7-5A3D-4677-80BE-E7501A058598

Fig. 17

Description. Female. Fore wing length 3.8 mm.

Face at level of antennal sockets 0.9 times as wide as high; face fairly sparsely punctate, shining, eyes setose, dorsal ridge of face in between antennal sockets without a median prominence; face profile gently curved, edge of clypeus somewhat impressed, margin straight, antennal sockets not on a distinct high shelf; subocular sulcus gently curved; maxillary palp long, reaching back to fore coxae. In dorsal view, head posteriorly moderately concave, temples distinct, lateral ocellus distant from eye by its maximum diameter, POL 1.1 times as long as diameter of lateral ocellus, ocellar-ocular grooves

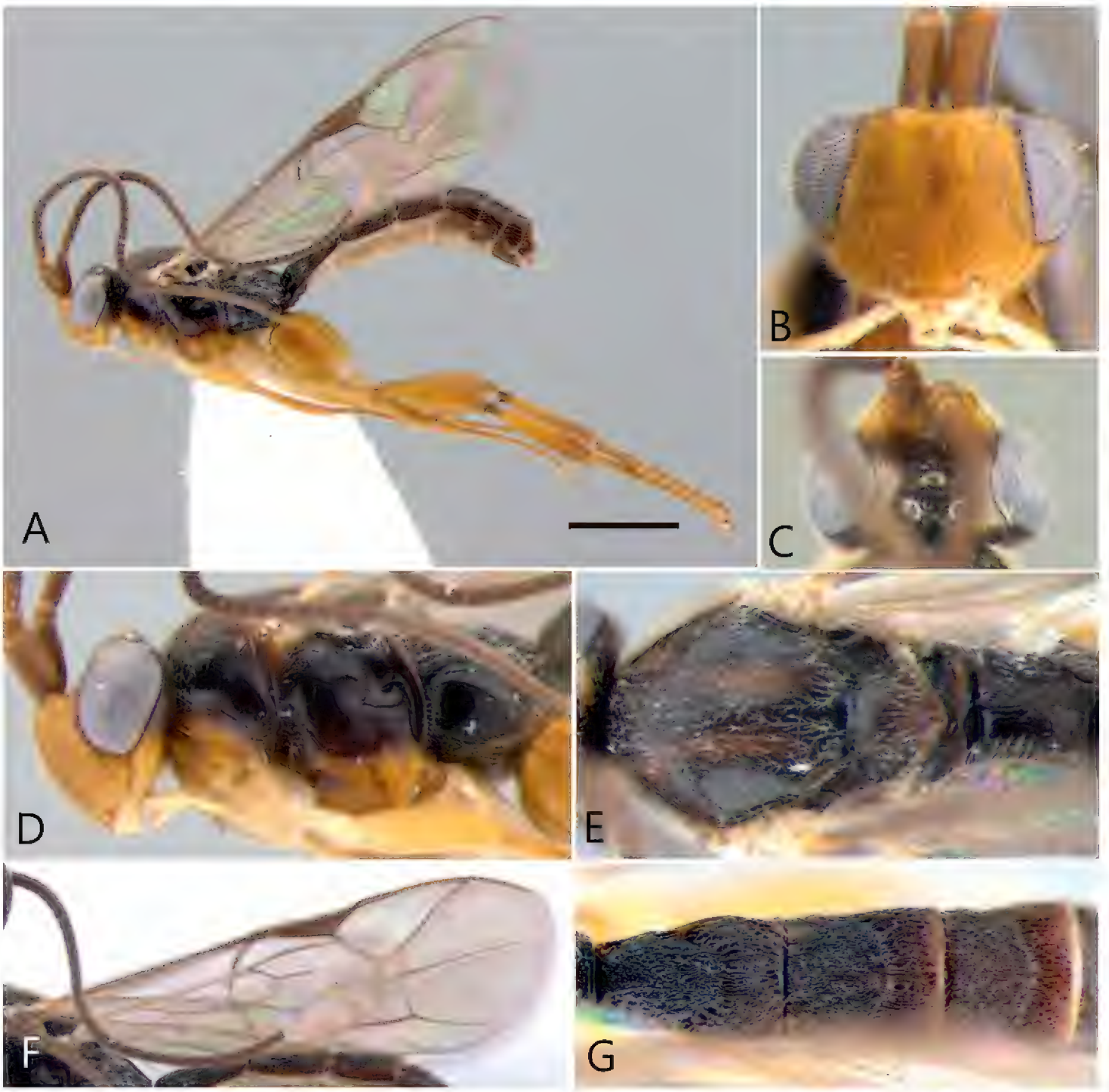

Figure 17. *Orthocentrus trichophthalmus* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** fore wing **G** first to third tergites in dorsal view.

absent. Minimum distance between antennal sockets about 0.4× diameter of socket; antenna long, slender, with 45 flagellomeres which gradually shorten towards apex of antenna; first flagellomere 2.1 times as long as wide and 0.6 times as scape length; scape slightly curved, in frontal view a little concave on lateral surface, convex on inner surface.

Mesosoma smooth, polished, impunctate except mesoscutum with shallow punctures, some faint coriaceous/rugose microsculpture on propodeum; mesoscutum lacking notauli; in profile, scutellum weakly convex, metapleuron slightly convex; propodeum with posterior transverse carina strong and raised, lateromedian longitudinal carinae complete, spiracle not particularly large.

Legs stout, hind leg massive; hind femur 3.1 times as long as maximum depth, hind tibia 4.1 times as long as apical width; tibiae lacking spine-like setae.

Wings not particularly narrow; fore wing with narrowly sessile areolet, slightly shorter than high, pterostigma narrow, vein Rs+2r meeting pterostigma at apical third; vein Rs nearly straight; nervellus intercepted below, angulate.

First tergite somewhat elongate and apically slightly widening, 1.6 times as long as posteriorly wide; heavily rugose without lateromedian longitudinal carinae, with transverse impressions originating at about middle of tergite, sloping posteriorly, and meeting centrally by transverse furrow. Second tergite 1.2 times as long as posteriorly wide; heavily rugose, with transverse impressions originating at about middle of tergite, sloping posteriorly, meeting centrally, delimiting vaguely defined rhombic area centrally; thyridia present. Third tergite with rugose/strigose sculpture, sculpture towards posterior edge smoother, with transverse impressions originating at about middle of tergite, sloping anteriorly, meeting centrally. Posterior tergites slightly coriaceous. Ovipositor thin, straight, without dorsal notch; ovipositor sheaths short, concealed by large hypopygium.

Setae over whole body except pronotum, mesopleuron, metapleuron, scattered on propodeum and dorsal sides of coxae.

Blackish-brown; flagellomeres brown, dull orange basally; face clypeus and malar space dull yellow/pale orange, frons fuscous, vertex with creamy orbital marks between eyes and ocelli, small pale area behind subocular sulcus; indistinct reddish-brown patches at anterolateral margins and whole course of notauli (if they were impressed), scutellum brown; propleuron, ventrally on pronotum and lower third of mesopleuron pale orange; legs basically dull yellow/orange, narrow basal band on hind tibia dark brown, fore and mid coxa, all trochanters and trochantelli pale. Tergites dark brown, second and third tergites narrowly dull orange apically. Sternites creamy with yellow more sclerotized patches.

Male. Unknown.

Biology. Hosts unknown.

Etymology. Named from the Greek *τρίχα* (hair) and *οφθαλμός* (eye) after the densely setose eyes.

Comparison. Compared with the other species that have densely setose eyes, it is much larger, the mesoscutum with reddish bars along notauli, antennae comparatively long, with 45 flagellomeres, unlike in *O. trichoptilus*, *O. hirsutor* and *O. setosus*.

Material examined. ***Holotype:*** female; South Korea, **GW**: Wonju-si, Heungeop-myeon, Maeji-ri 234, Yonseidae, MT, 31.VII–5.IX.2014, H.Y. Han leg. (DNUE).

Distribution. South Korea (GW).

25. *Orthocentrus trichoptilus* Humala & Lee, sp. nov.

http://zoobank.org/CD88033B-260C-4849-AE85-F11B59BCB724

Fig. 18

Description. Female. Fore wing length 2.6 mm.

Face at level of antennal sockets 1.1 times as wide as high; face matt, finely and densely pustulate, frons finely pustulate with hairs, temples with fine matt-like coriaceous sculpture; eyes setose; dorsal ridge of face in between antennal sockets without a median

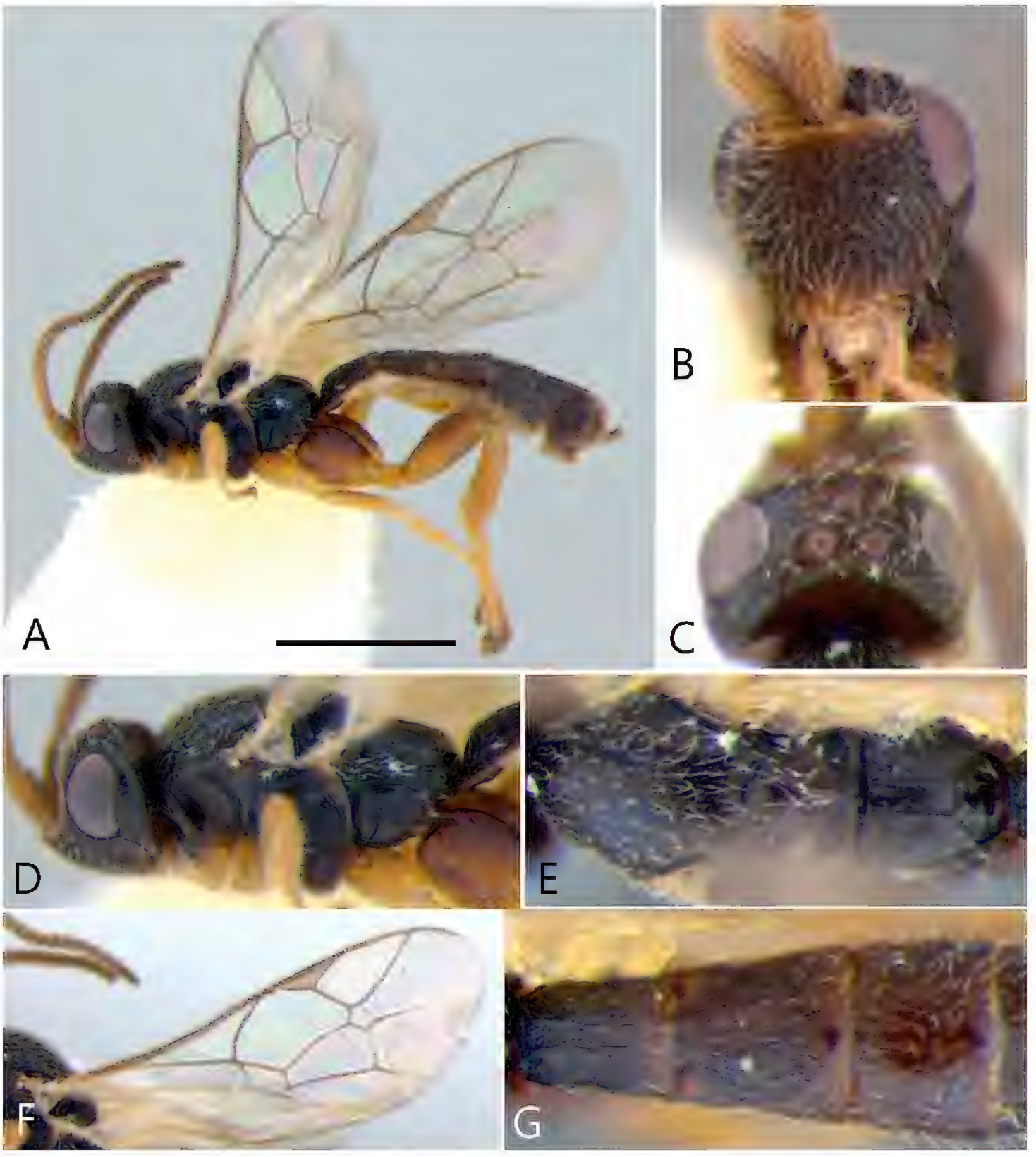

Figure 18. *Orthocentrus trichoptilus* sp. nov. Holotype. **A** Habitus in lateral view **B** head in frontal view **C** head in dorsal view **D** head and mesosoma in lateral view **E** mesosoma in dorsal view **F** fore wing **G** first to third tergites in dorsal view.

prominence; face in profile almost straight, slightly impressed dorsally, edge of clypeus straight, antennal sockets on a high shelf; subocular sulcus distinct, sharp, bent towards occiput; maxillary palp reaching to about epicnemial carina. Head in dorsal view posteriorly deeply concave, temples distinct, lateral ocellus separated from eye by a distance 2 times 1.3 times longer than its maximum diameter, POL 0.9 times as long as diameter of lateral ocellus, ocellar-ocular grooves lacking. Minimum distance between antennal sockets very narrow, sockets almost touching each other; antenna short, moniliform,

with 24 transverse flagellomeres, apical flagellomeres subquadrate, first flagellomere 0.8 times as long as wide and about 1/3 of the scape length, scape nearly parallel-sided.

Mesosoma smooth and polished except mesoscutum and scutellum regularly punctate, dorsal propodeum with coriaceous microsculpture; mesoscutum lacking notauli; in profile, scutellum weakly convex, metapleuron slightly convex; propodeum with posterior transverse carina present between lateral longitudinal carinae, lateromedian longitudinal carinae complete, diverging anteriorly; spiracle small.

Legs broad, coxae polished, femora polished-coriaceous, tibiae and tarsi coriaceous-granulate; hind femur 2.5 times as long as high, hind tibia 3.8 times as long as apical width, with spine-like setae.

Wings not particularly narrow; fore wing with areolet closed, areolet comparatively large, about as high as wide, 2m-cu meeting areolet at apical 0.7, vein Rs straight; nervellus not intercepted, gently curved.

First tergite elongate, posteriorly widening, 1.6 times as long as posteriorly wide; coriaceous-rugose, without developed lateromedian longitudinal carinae. Second tergite 0.7 times as long as posteriorly wide; coriaceous-rugose, posteriorly polished, with shallow transverse impressions originating at about middle of tergite, sloping posteriorly and meeting centrally; anterior thyridia oval-rectangular. Remaining tergites smooth and polished, third tergite with shallow punctures, without thyridia; third tergite sometimes anteriorly narrowly coriaceous-strigose. Ovipositor straight, without notch; ovipositor sheaths slightly widened apically with sparse backward-pointing setae.

Body largely setose except pronotum, mesopleuron and metapleuron; setae few and scattered on propodeum and posterior sides of coxae.

Dark brown except mouthparts, upper margin of face and small marks between inner orbits and antennal sockets, fore and mid legs, tegula, light yellow; sternites creamy, propleuron ventrally, legs largely except dorsal half of hind coxa and hind femur dorsally yellow; division of dark and pale colours blurred.

Male. Unknown.

Biology. Hosts unknown.

Etymology. Named from the Greek *τρίχα* (hair) and *οπτικθσ* (optics, eye) after the relatively dense setae on the surface of the eyes.

Comparison. Compared with the other species that have densely setose eyes, the face, mesoscutum, propleuron and mesopleuron are fuscous, the subocular sulcus distinct, the antennae comparatively short with 24 flagellomeres, unlike in *O. trichophthalmus*, *O. hirsutor* and *O. setosus*.

Material examined. ***Holotype:*** female; South Korea; **JB**: Muju-gun, Mupung-myeon, Hyeonnae-ri San 3, Mt. Bakseoksan, MT, 17.VI–2.VII.2015, J.W. Lee leg. (DNUE).

Distribution. South Korea (JB).

26. *Orthocentrus winnertzii* Förster, 1850

Figs 19C, D

Biology. Parasitoid of *Sciophila rufa* Meigen (Diptera, Mycetophilidae).

Figure 19. *Orthocentrus* spp. **A** Habitus in lateral view of *O. stigmaticus* **B** head in frontal view of *O. stigmaticus* **C** habitus in lateral view of male of *O. winnertzii* **D** head in frontal view of male of *O. winnertzii*.

Material examined. South Korea, **GB:** 1♂, Gyeongsan-si, Yeungnam University, 19.IV.1989, J.G. Kim leg. (DNUE–0478); **GW**: 1♀, Wonju-si, Panbu-myeon, Mt. Baegunsan, MT, 5.IX–16.X.2013, H.Y. Han leg. (DNUE); 1♂, Taebaek-si, Hyeol-dong, Yilsa, 37°0'41.79"N, 128°55'26.46"E, 30.VI.1991, J.W. Lee leg. (DNUE); Japan: 1♀, Hokkaido University, Kita 8, Nishi 5, Kita-ku, Sapporo, Hokkaido, 30.VII–21. VIII.2013, S.H. Oh leg. (DNUE–0050).

Distribution. Holarctic; *South Korea (GB, GW), *Japan.

Discussion

Altogether 25 species of *Orthocentrus* are found to occur in South Korea, previously none of these had been reported from this country, and neither had the genus *Orthocentrus*. Among them, 15 species are new to science and 10 are known species of Palaearctic or Holarctic distribution. After this work, the Korean fauna of *Orthocentrus* can be considered the best studied in the East Palaearctic. Unfortunately not all the

available males were associated with specific females, and probably the use of molecular methods could help to solve this problem in a future study.

All of the scarce reliable observations of *Orthocentrus* hosts are restricted to the genera *Sciophila* Meigen and *Neoempheria* Osten Sacken (Diptera, Mycetophilidae): *O. asper* was reared from *Sciophila lutea* Macquart (Šedivý and Ševčik 2003), *O. protervus* from *Sciophila hirta* Mg. (Roman 1923), *O. stigmaticus* from *Sciophila rufa* Mg. (Kolarov 1986), and unidentified *Orthocentrus* species from *Neoempheria carinata* Sueyoshi (Mukai and Kitajima 2019). No biological information concerning *Orthocentrus* hosts is available from South Korea.

Veijalainen et al. (2014), after studying *Orthocentrus* in the Neotropics, concluded that the genus is not monophyletic and perhaps should be divided. They proposed five species-groups, and some of them (e.g. *O. maculae* and *O. shieldsi* species-groups), could be found also in the Palaearctic fauna. We agree with their opinion in general; however, to address the possible split of *Orthocentrus*, a more comprehensive analysis is needed, ideally including specimens from all regions of the world. For the moment, this division could not be applied to the Palaearctic species of the genus, as many distinctive characters overlap and consequently the species-group definitions do not fit well to many species from our study.

Orthocentrinae still remains an incompletely investigated group if compared with other ichneumonid subfamilies and requires much more taxonomic attention; however, the efforts of several researchers resulted in some progress in this field during the last few decades. Despite this the number of unknown Orthocentrinae species remains very high, especially in the tropical regions.

Acknowledgments

We are deeply grateful to the reviewers and the subject editor Gavin Broad for reviewing this manuscript and constructive criticism that improved this paper. Also, our thanks to Dr Hae-Chul Park (NIAS curator) for providing material for this study. This work was carried out under state order to the Karelian Research Centre of the Russian Academy of Sciences (Forest Research Institute) and supported by a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR201801201 and NIBR201902205).

References

Aubert JF (1978) Révision préliminaire des Ichneumonides Orthocentrinae européennes (I) (Hymenoptera, Ichneumonidae). Eos 52: 7–28.

Eady RD (1968) Some illustrations of microsculpture in the Hymenoptera. Proceedings of the Royal Entomological Society of London (A) 43: 66–72. https://doi.org/10.1111/j.1365-3032.1968.tb01029.x

Gauld ID (1991) The Ichneumonidae of Costa Rica 1. Memoirs of the American Entomological Institute 47: 1–539.

Gravenhorst JLC (1829) Ichneumonologia Europaea. Pars III. Vratislaviae, 1097 pp. https://doi.org/10.5962/bhl.title.65750

Humala AE (2007) Subfamily Orthocentrinae. In: Lelej AS (Ed.) Opredelitel' nasekomykh Dal'nego Vostoka Rossii [Keys to the Insects of the Russian Far East], Dal'nauka, Vladivostok, Vol. 4, 680–718. [In Russian]

Humala AE (2019) Mexican species of the genus *Orthocentrus* (Hymenoptera, Ichneumonidae: Orthocentrinae). Zootaxa. 4709 (1): 1–83, https://doi.org/10.11646/zootaxa.4709.1.1

Humala AE, Choi JK, Lee JW (2016) A review of the genera *Gnathochorisis* Förster and *Symplecis* Förster of South Korea with notes on Korean orthocentrines (Hymenoptera: Ichneumonidae: Orthocentrinae). ZooKeys 562: 85–104. https://doi.org/10.3897/zookeys.562.7303

Humala AE, Choi JK, Lee JW (2018) A review of the genus *Eusterinx* Förster (Hymenoptera, Ichneumonidae, Orthocentrinae) from South Korea with descriptions of five new species. Entomological Science 21: 97–111. https://doi.org/10.1111/ens.12287

Kasparyan DR, Khalaim AI, Tereshkin AM, Humala AE, Proschalykin MYu (2012) 47. Ichneumonidae. In: Lelej AS (Ed.) Annotated Catalogue of the insects of Russian Far East. Hymenoptera, Dal'nauka, Vladivostok, Vol. 1, 210–299. [In Russian]

Kolarov J (1986) A revision of the Orthocentrinae of Bulgaria (Hymenoptera, Ichneumonidae). Annales Historico-Naturales Musei Nationalis Hungarice 78: 255–264.

Mukai H, Kitajima H (2019) Parasitoid wasps regulate population growth of fungus gnats *Neoempheria* Osten Sacken (Diptera: Mycetophilidae) in shiitake mushroom cultivation. Biological Control 134: 15–22. https://doi.org/10.1016/j.biocontrol.2019.03.016

Roman A (1923) Ichneumonids reared from Diptera Nematocera. Entomologist's Monthly Magazine 59: 71–76.

Šedivý J, Ševčik J (2003) Ichneumonid (Hymenoptera: Ichneumonidae) parasitoids of fungus gnats (Diptera: Mycetophilidae): rearing records from the Czech Republic. Studia Dipterologica 10: 153–158.

Townes HK (1971) The genera of Ichneumonidae, part 4. Memoirs of the American Entomological Institute 17: 1–372.

Veijalainen A, Broad GR, Sääksjärvi IE (2014) Twenty seven new species of *Orthocentrus* (Hymenoptera: Ichneumonidae; Orthocentrinae) with a key to the Neotropical species of the genus. Zootaxa 3768(3): 201–252. https://doi.org/10.11646/zootaxa.3768.3.1

Watanabe K (2016) Discovery of the Genus *Neurateles* Ratzeburg, 1848 (Hymenoptera, Ichneumonidae, Orthocentrinae), from the Eastern Palearctic Region, with Description of a New Species from Japan. Bulletin of the Kanagawa Prefectural Museum (Natural Science) 45: 81–84.

Watanabe K (2018) Discovery of the Genus *Terminator* Humala, 2007 (Hymenoptera: Ichneumonidae: Orthocentrinae) from Japan. Japanese Journal of Systematic Entomology 24(2): 254–256.

Watanabe K (2019a) New Distribution Records of the Subgenus *Fugatrix* Rossem, 1987 of the Genus *Plectiscidea* Viereck, 1914 (Hymenoptera: Ichneumonidae: Orthocentrinae) from Japan. Japanese Journal of Systematic Entomology 25(1): 49–52.

Watanabe K (2019b) Review of the Genera *Aniseres* Förster, 1871 and *Catastenus* Förster, 1868 (Hymenoptera: Ichneumonidae: Orthocentrinae) from Japan. Japanese Journal of Systematic Entomology 25(1): 81–85.

Yu DSK, Achterberg van C, Horstmann K (2016) Taxapad 2016, Ichneumonoidea 2015. Database on flash-drive. Nepean, Ontario, Canada.